



and drop when nestlings were present  
**(8)** diets of female crows consisted of mainly wheat (waste) and mice in 17 of the 20 gizzards  
**(9)** rodents were a source of fat, protein, and calcium for the female crows y19

### Egg dates

Throughout its North American breeding range, from Florida to British Columbia, first egg dates varied with latitude. A summary from several sources is below. These dates are based on a wide range in the number (n) of nests observed. Dates of first eggs laid by American Crows –

**Florida** lat. 27° January 17 31s  
**Florida** lat. 27° February 27 k47  
**Oklahoma** lat. 35° February 28 n22  
**California** lat. 38° April 6 e40  
**Virginia** lat. 38° March 14 c69  
**Pennsylvania** lat. 41° March 20 2b1  
**Ontario\*** lat. 43° est. March 24 (pers. obser.)  
**Saskatchewan** lat. 51° May 1 32h  
 \* March 3 was the earliest date in ON p25.

Here is a brief summary of eggs dates for



A crow's tail protruding above a nest's rim in the afternoon is a good indication that incubation or brooding is underway

crows in provinces and states g75. I added a few outside sources (renests included) –

**Alberta** 2 May–9 June (n 21)  
**British Columbia** 17 April–4 June (n 10)  
**California** 21 March–12 June (n 112)  
**Central California** 6 April–29 April (n 52) e40  
**Encino, California** 17 March–26 April v18  
**Florida** 21 January–27 May (n 52)  
**Illinois** 27 March–22 May (n 39)



Ideal nesting location in **Winnipeg**. For several years this unmarked pair, without a helper, nested in the spruce. In 2012 they built a nest in the row of American Elm east of the conifers (yellow arrow, nest not visible). The male sat on the edge of the building across the street (dark arrow) and guarded their territory. A park to the right provided insects and worms for the family of crows. A raven's nest 180 m to the east (right) was successful for several years. No interactions between the two corvids were observed, 16 April 2012





As she incubates, he adorns the lookout pole less than 100 m from the nest in an American Elm on the University of **Winnipeg** campus

**Illinois** 2 April–11 May h90  
**Kansas** 3 March–15 May (n 22)  
**Maine** 16 April–27 May (n 60)  
**Manitoba** 19 April–20 June t18  
**Maryland** 13 March to 20 May (n 243) 48s  
**Minnesota** 6 April–20 June (n 10) r85  
**New Brunswick** 15 April–4 June (n 15) 32s  
**New Jersey** 30 March–12 June (n 146)  
**New York** 30 March to 14 June, (n 103) 1b3  
**Oklahoma** 25 February–15 April v18  
**Ontario** 14 April–5 July (n 12)  
**Oregon** 16 April–27 May (n 17)  
**Quebec** 23 April–14 May 62m  
**Saskatchewan** average date for a nest with eggs  
 12 May (n 1,000) 33h  
**Texas** 28 February–26 April (n 9)  
**Virginia** 14 March –19 May (n 29) c69  
**West Virginia** 5 April–28 May (n 27)  
**Washington** 22 April–22 May (n 6)

Near Saskatoon **Saskatchewan** (lat 52°), the mean clutch starting dates were May 6 and 12 for two locations in parkland. Eggs were usually (18 of 20 nests) added one a day i04. In the 1920s, Horning located a nest with three eggs. The branch with nest attached was cut and stuck at an angle of 55° into the ground. The eggs were collected. Returning a few days later, four new eggs were in the nest. These were also removed. The crows finally gave up 28h. Mr FL Burns on 22 April 1897, located a crow's nest with two nestlings about a week old and another nest with 6 eggs, which he collected. The latter nest was lined with human hair g57.

### Clutch size

With this brief introduction on the crow's reproductive anatomy and egg dates over, I will continue with the amazing collection of facts associated with nesting. To begin, the average clutch size was 4.5 for 14 "undisturbed" nests from a colony of crows in **California** e40. These figures agreed with Black's 2-year study in **Illinois**. In that state, 72 nests gave a mean of 4.5 eggs per clutch and about 50% of the nests had a clutch of 5 eggs. By 30 April, 68% of the nests contained nestlings 20b. In Ithaca **New York**, an average clutch was 4.7 eggs in nests of crows in the city and country,





**American Crow** fledgling at the end of a wing stretch. The right wing and leg are being pulled in. The toes of the left foot have a tight grip on the 2 cm wide branch. The hallux (toe 1) and the inner toe 2 almost form a straight line. Toe 4, the outer one, is angled away from the other forward pointing toes 2 and 3, which are parallel to each other and often touching

with an average of 3.9 eggs hatching per urban nest and 4.1 hatching per rural nest. The survival of nests with eggs did not differ between urban and rural landscapes in New York state m85.

Although the usual rate of laying was one egg per day, 2 days were skipped between eggs 2 and 3 in one nest and between eggs 3 and 4 at two other nests i04. Near Davis **California**, crows' eggs were laid daily in 43 nests, and in 10 of 14 (71%) nests an extra day passed prior to the addition of the last egg. Eggs were usually laid in the late morning e40.

Clutch sizes were altered by adding and removing eggs. Egg removal in 56 nests with an average of 4.3 eggs laid, meant only 32 eggs advanced to the incubation stage. Even with the addition of up to 5 eggs to each of five nests during the laying period, the female laid normal clutches of 4 or 5 eggs, in spite of the crowding. If a clutch was abandoned or robbed entirely, the crow may lay a replacement clutch 7–12 days later e40, c11.

In **British Columbia**, the average clutch size was 4.7 (3–7) eggs at 124 nests c31. In the fields of **Saskatchewan**, 104 clutches were measured and weighed. The average clutch size was 4.8 eggs among clutch sizes of –

**3 eggs** – 3 nests 3%  
**4 eggs** – 23 nests 22%  
**5 eggs** – 73 nests **70%**  
**6 eggs** – 5 nests 5% i04

In the late 1800s, collecting eggs from nests was fashionable. Rarely is this done today. One engaging story was from Henry Beaumont in Nashville **Tennessee**. A male crow, marked on its left foot from a rifle ball in 1892, remated in 1893 after its mate was killed. His new mate re-modeled the old nest, and produced a clutch of 5 eggs. These were taken on 7 May. On 13 May another set of 5 eggs was collected. On the 25th, the mated pair were killed. Three fresh eggs were in the nest and the female held a fourth about to be deposited 2b4.

CW Crandall of Woodside **New York** had four sets of 7 eggs in his collection 2b4. Nests holding a clutch of 8 and 9 eggs have been reported g75. Richard F Miller found one nest with 8 eggs and 2 nests, each with 9 eggs. It is possible that double sets by two female crows may account for these large clutches, although this has never been proven. Different levels of incubation may indicate two clutches in one nest r37.

Dr S Dickey mentioned the first egg was laid a day or two after the nest was completed, or after a longer delay if the weather turned cold g75. Kilham counted 6–16 days before eggs were deposited in 2 completed nests k63. In **California** crows laid eggs right after some nests were built. For 57 sets of eggs –

**2 eggs** – 2%  
**3 eggs** – 11%  
**4 eggs** – 33%  
**5 eggs** – **51%**  
**6 eggs** – 3% e40

There was little difference in clutch sizes between the northern and central parts of **Illinois**. The overall clutch size averaged 4.8 eggs. Clutch sizes for 137 nests –





- 2 eggs – 2%
- 3 eggs – 8%
- 4 eggs – 19%
- 5 eggs – 50%
- 6 eggs – 17%
- 7 eggs – 4%

In **Kentucky** the average of 10 clutches was 4 with a range of 3–5 eggs. A compilation listed 1–10 of April as peak of clutch completion in the state. The earliest date for a fresh egg was on 29 March 1924, and the latest clutch was on 22 May 1922, which was slightly incubated 16m.

Similarly, 180 eggs from 40 clutches of Hooded Crows, *Corvus corone cornix*, in western **Poland** over two breeding seasons, 2000–2001, had an average clutch size of 4.5 (3–6) eggs with 5 eggs occurring most frequently 204.

## Size of eggs

Three large collections of eggs from American Crows will suffice to illustrate their size. Good measured 273 eggs in the **Ohio** collection of Homer Price. The egg averages were –

- 4.1 (3.5–4.9) cm
- 2.9 (2.6–3.2) cm

Both the longest and shortest eggs had a diameter of 2.8 cm. One infertile runt egg in a clutch of four measured 3.1 by 2.2 cm 934. With little difference, 292 eggs in the United States National Museum averaged –

- 4.1 (3.6–4.7) cm
- 2.9 (2.6–3.1) cm

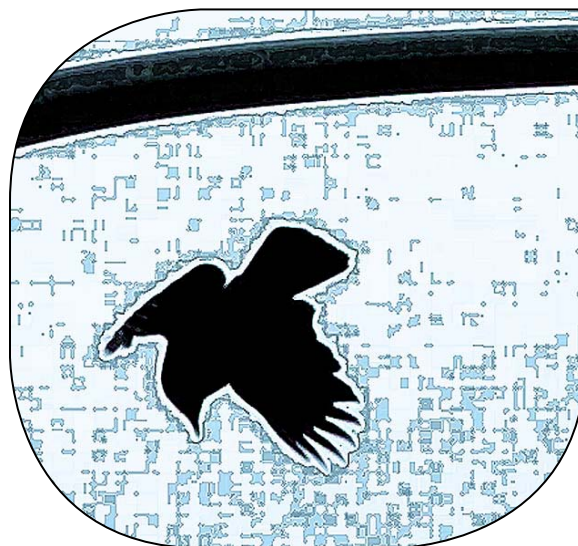
From measurements of 979 eggs from 16 locations in the USA and Canada, the average size was 4.2 cm by 2.9 cm 2b4

A total of 426 fresh eggs in four groups of nests near Saskatoon **Saskatchewan**, gave these range averages –

- Length** 4–4.2 cm
- Width** 2.9 cm
- Volume** 17–18 cm<sup>3</sup> i04.

Smaller crows in **Florida** had these extreme measurements – longest egg 4.5 cm and smallest egg width 2.0 cm b80.

Averages are easily surpassed. Scouting around **Oklahoma**, a huge crow was flushed from its nest in a small pecan tree. Her five eggs averaged 5.1 by 3.2 cm, which placed them within the range of a raven's p34. A set of Raven's eggs in southern **California** ranged from 4.6–5.3 cm long by 3.3–3.6 cm wide l48. Birds of North America online, gave a range of 4.4–5.2 cm by 3.1–3.6 cm.



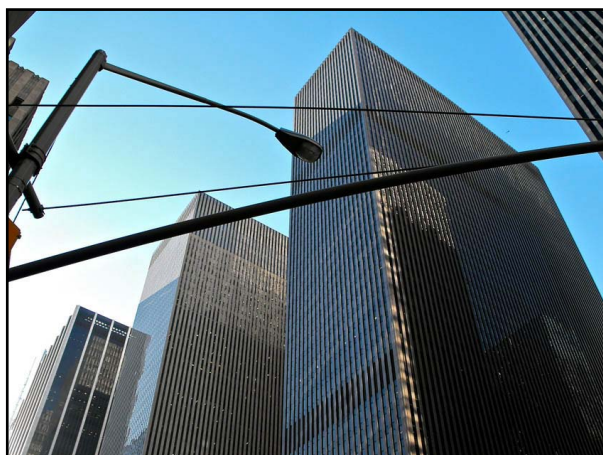
IC Green from Amherst **Massachusetts** found a runt crow's egg among 3 eggs of normal size. It had no yolk and was 3.0 x 2.4 cm. Another runt egg was 2.2 by 1.4 cm in size 33h. An almost round egg was taken from a set of 2 eggs on 1 May 1893 by JC Brown in Carthage **Missouri**. This round egg was 3.6 x 3.5 cm 2b4.

Eggs of the Hooded Crow, *Corvus corone cornix* were collected near Trondheim in central **Norway**. From 110 complete clutches (average of 4.7 eggs per clutch) the average sizes –

- Length 4.2 (3.4–4.8) cm
- Width 2.9 (2.6–3.3) cm

These two measurements were similar to those for eggs of the American Crow. In **Norway**, eggs that usually failed to hatch were the smaller eggs, those laid toward the end of a clutch. Due to asynchronous hatching, if one nestling was to die





Along The Avenue of the Americas (6th Avenue) in New York, a lack of trees eliminates nesting by American Crows

from starvation, it was usually the nestling from the last (smallest) egg

Measurements of 180 eggs of Hooded Crows in western **Poland** gave ranges of –

**Length** 3.5–4.7 cm

**Width** 2.6–3.2 cm

For Hooded Crows the largest variation was in egg volume and the smallest variation in egg width. The volume of a larger egg can only be achieved by elongation of the egg. The largest eggs in a population may occupy twice the volume of the smallest eggs. It was suggested the eggs were quite similar because of the food storage culture of the crow. Where this study was done, water levels fluctuated suddenly and frequently. Storage of food allowed the crows to weather the high waters during the egg-laying period

Because eggs of the Hooded Crow were quite similar in average size and range to those of American Crows, it seems to me that a population of crows where their habitat was more stable, such as in Winnipeg **Manitoba**, also store excess food throughout the year. Perhaps American Crows store food because they can, and to avoid wasting or losing food on their territory. Maybe their appetite is not as large as depicted by some past research. Crows are not gluttonous.

## Weight of eggs

The first egg in a clutch of the smaller race of American Crows in Davis **California** was often heavier than the last egg. Overall, smaller clutches have individually heavier eggs –

**3 eggs** – Ave 51.2 g; Ave egg 17.1 grams (n 3)

**4 eggs** – Ave 66.7 g; Ave egg 16.7 grams (n 10)

**5 eggs** – Ave 82.4 g; Ave egg 16.5 grams (n 3)

The average weight for 157 eggs was 16.6 (12.5–21.3) grams. From eggs in 10 full clutches (sets), the average weight of the first egg laid was 17.1 g while the last egg laid was 15.7 grams each. However, in two clutches the last egg was heavier than the first egg. Eggs (n 90) in early nests (laying started before 30 April) compared to eggs (n 67) in later nests had equal average weights of 16.6 grams. In **Saskatchewan** 92 fresh American Crow eggs had an average weight of 18.1 grams. In **British Columbia** the average weight of 87 fresh eggs of the smaller Northwestern Crow was 17.8 grams.

From dry eggs in museums, the average shell thickness was 0.18 mm for 5 eggs of the American Crow, and 0.16 mm for 5 eggs of the smaller Fish Crow. The thickness included the shell and inner membrane of freshly laid eggs when collected

## Content of eggs

For 23 altricial species, including the Black-billed Magpie, some egg components –

**Solids** 16% of content

**Water** 84% of content

**Lipids** 6% of content

Kcal / gram **wet** mass 1

Kcal / gram **dry** mass 7

**Lipids** 3% dry mass

For birds like the American Crow with altricial young, the fraction of yolk in egg contents was (18%) and the fraction of water in egg contents was (83%). For a Canada Goose, with precocial young, the egg contents were 44% yolk and 72% water. Overall, as the relative yolk content





increased, there was a decrease in the relative water content. The maturity of the hatchling also increased from altricial to precocial species. Lipids comprise about 58% of all yolk solids 19s.

## Volume of eggs

From 292 eggs of the American Crow, the average volume was 16.5 ml, which is similar to the weight of a fresh egg. Fish Crows, *Corvus ossifragus*, which are smaller than American Crows, had an egg volume of 13.5 ml (n 46) 25s. In **Saskatchewan**, from two study areas over two years (1987–'88), the average volume of 426 eggs in 4 subsets ranged from 16.9–18 cm<sup>3</sup>. The mean volume of the first three eggs of the American Crow (35 eggs from 17 nests) was noticeable larger than the last two eggs in a clutch (18 eggs from 11 nests). Egg volumes changed as eggs were added to a clutch i04.

Dozens of eggs from 83 species of birds were hatched under laboratory conditions at a temperature of 37.8 °C and 64% relative humidity w61. A formula was developed to match egg volumes to incubation period. For the American Crow, the figures were volume 1.15 in<sup>3</sup> (18.8 cm<sup>3</sup>), which translated into an incubation period of 16.5 days 44w. Without applying the formula, the volume of 18.8 is closer to the actual number of days for incubation than the 16.5 days. The specific gravity of 1 (neutrally buoyant in water at 37 °C) was reached 11 days prior to hatching. At a specific gravity of 1, the weight of an egg (grams) = the volume of the same egg (cm<sup>3</sup>) w61.

In clutches of five eggs of the Northwestern Crow, the average volume of the first two eggs was 16.6 and 16.8 cm<sup>3</sup>. Thereafter, the egg size declined to 15.5 and 15.3 cm<sup>3</sup> for the 4th and 5th eggs 4b0. Verbeek collected egg data on the Northwestern Crow from 1983–'86 on Mitlenatch Island **British Columbia**. Average volumes of complete egg clutches –

### 3 EGG CLUTCHES (volumes cm<sup>3</sup>)

Average egg 16.8 (n 18)  
Smallest egg 16.1 (3rd egg laid)  
Largest egg 17.1 (2nd egg laid)

### 4 EGG CLUTCHES (volumes cm<sup>3</sup>)

Average egg 15.9 (n 28)  
Smallest egg 15.3 (4th egg laid)  
Largest egg 16.2 (2nd egg laid)

### 5 EGG CLUTCHES (volumes cm<sup>3</sup>)

Average egg 16 (n 19)  
Smallest egg 15.2 (5th egg laid)  
Largest egg 16.5 (2nd egg laid)

Regardless of clutch size, the smallest egg was on average the last one laid and the largest egg was on average the 2nd egg laid by the Northwestern Crow. The last egg in a three clutch size was also the palest in 53 of 82 (65%) clutches, and the first egg laid the palest in 13 of 82 (16%) clutches. Northwestern Crows predated each others' nests on the island. Missing marked eggs were not chosen randomly. For each of 17 full clutches with one pale egg, the palest egg was taken from 12 (71%) of the nests. The volume / size of eggs was not selected for by predators. The hatching rate of marked eggs did not vary by their volumes / sizes. But the last egg in a clutch



**American Crow 8-day old** nestlings high in a pine tree indicate their hunger, Ithaca, NY, © By Dr. Kevin J McGowan, with notification. From Birds of North America online





was at a disadvantage in three ways –

- (1) it was the last to hatch
- (2) the smallness of the egg produced a smaller nestling
- (3) the pale color of the egg made it more obvious to predators, which took it more often than the other eggs in a clutch v11.

The mean egg volume of all eggs of the Hooded Crow (body weight 490 g) was 18.5 (18.3–19.3) cm<sup>3</sup>. When comparing the last eggs in a clutch, the ones that hatched were 16.1 cm<sup>3</sup>, and the last eggs that did not hatch had a volume of 14.8 cm<sup>3</sup>. The last egg in a clutch had an average volume 5–7% smaller than the mean size of all preceding eggs in a clutch (**Graph 105**). The last eggs laid in a clutch were smaller and were an “adaptive measure that facilitates brood reduction.” Asynchronous hatching and less than suitable environmental conditions for raising nestlings allowed for brood reduction in the Hooded Crow s92.

In the early 1980s, measurements of eggs of the Hooded Crow, *Corvus corone cornix* near Trondheim in central **Norway** gave a mean egg volume of 18.4 cm<sup>3</sup> within a range of 12.5–24.9

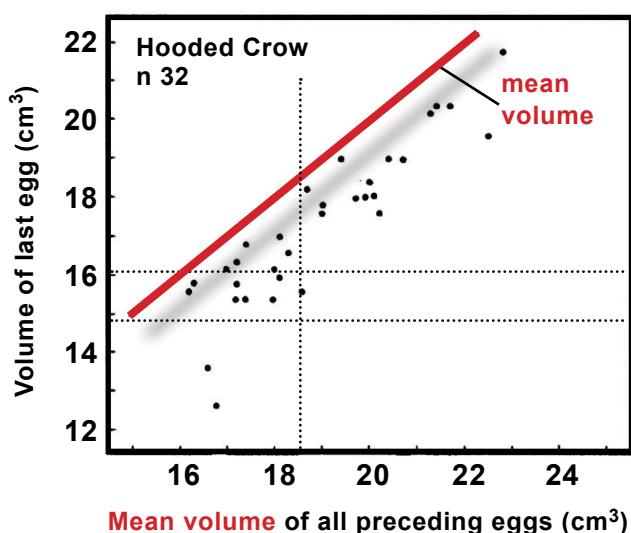
cm<sup>3</sup>. Heavier nestlings hatched from larger eggs. Within clutches, the volume of the first egg was generally larger than the mean, and the last egg’s volume smaller than the mean. However, in clutches of 3–6 eggs (mean 4.7) the larger the clutch size the smaller, relatively, was the first egg. And the volumes of eggs from which female and male crows hatched were similar 06r.

For Hooded Crows in **Poland**, the 40 clutch means for egg volume were 17.5 (12.9–21.8) cm<sup>3</sup>. The volume range for 180 eggs was 11.9–23.8 cm<sup>3</sup> z04.

## Color of eggs

In a dark green conifer sits a black crow on a gray-brown nest that holds a treasure of eggs with a pastel bluish-green shell adorned with delicate spots and blotches of dark brown pigment. Why this particular color for an egg? The American Crow builds a large open-cup nest easily viewed from all sides when placed near the top of a deciduous tree, at least before the leaves are displayed. In a coniferous tree, the nest is near the trunk and usually hidden by branches and shadows from all sides. In a conifer, the eggs are only visible from above and at very close range. The cryptic coloration of the eggs should reduce predation, or so the theory goes. Predators (mammals, birds, snakes) may locate the nest because of its size, degree of exposure and placement, movement and calls of adults and nestlings, and smell, in spite of cryptic eggs.

In the farmland of eastern Bohemia in the **Czech Republic**, experiments were conducted on nests and colored eggs of three small passerines in an area with a corvid population. The Song Thrush, *Turdus philomelos*, builds a bulky, barely concealed nest 1.5–3 m above ground in trees and shrubs. The eggs, a light blue-green with sparse dark spots, contrast with the yellowish nest cup. Overall, no significant effect of egg color on nest survival was found for the three species. Nest concealment did increase nest survival. Egg color appeared to be a neutral trait. Yet, artificial brown eggs had a slightly higher survival rate than white eggs – 11% and 14% during 1998 and 1999 w46. Unlike small aggressive songbirds, American Crows are



**105.** For Hooded Crows, *Corvus corone*, in **Norway**, the final egg in a clutch was 5–7% smaller in volume when compared to the mean egg volume of all the preceding eggs in the same clutches of 4 or 5 eggs s92, © American Ornithologists’ Union





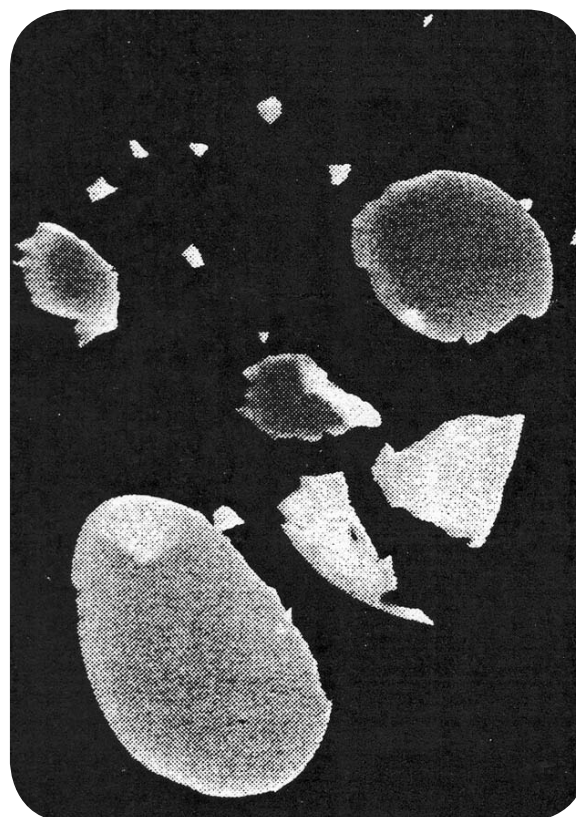
**Great Horned Owls** prey on crows. The adult is perched below a pre-owned nest holding 2 young. Large crow feathers are often found on the ground below a nest

large and aggressive, and rely on vision and hearing to alert them to potential nest predators. As in the above study, the color of a crow's egg may not matter.

Then why are the eggs of crows and many other species speckled? It's an old perplexing ornithological question. Variety and beauty are unprovable reasons, so they are not mentioned. The more logical one is to provide camouflage, but then why aren't all eggs speckled to lessen predation – for instance, heavily predated eggs of upland nesting waterfowl are an off-white with no markings, which makes them very visible in the grass, especially from above. Perhaps this is partly why the hen covers the eggs with her down before leaving the nest. A recent paper introduced a new possibility, which in my opinion has as many exceptions as the above anti-predation

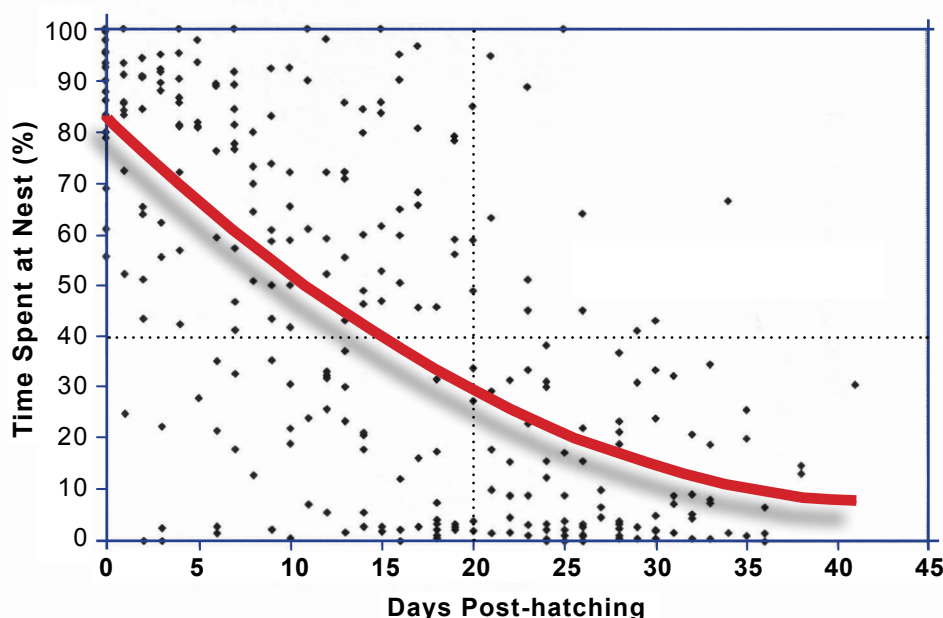
theory. The hypothesis suggests that the speckling is due to deposits of protoporphyrin pigments that may strengthen the shells at weak areas partially caused by a lack of calcium. "Variation on pigmentation was associated with variation in shell thickness both within and between clutches." Availability of calcium due to geological variability is involved 948. But I ask, why do American Robins typically have unspotted eggs and American Crows spotted eggs throughout their extensive ranges? Robins have an even greater range than the crow, with presumably a wide availability of calcium levels. And diets of the two birds have many similar items such as fruit, grain and invertebrates – the hard and soft bodied types.

From wiki, protoporphyrins are deposited in the shells of the eggs of some birds as a brown or red pigment, either as a ground colour or as spotting. This occurs in most passerine species, some ground-nesting non-passerines, such as waders, gulls, nightjars and sandgrouse, where it provides



Broken egg of an American Crow; photograph





**107. American Crow** Time spent by breeding females at their nests declined as the nestlings grew and began to regulate their own body temperature by day 15–18 over the 30–35 day nestling period h06, © Hackler 2007, MSc thesis, Oklahoma state University

camouflage, and some parasitic cuckoos, which need to mimic their hosts' eggs.

Protoporphyrins strengthen the egg shell, and are deposited where the shell is too thin as a result of calcium shortage. Spotting therefore tends to be heavier where the local soil is calcium-deficient, and in the last eggs laid in a clutch. Yet, for the American Crow, the last egg is often smaller, lighter and with fewer spots.

Only a handful of people have seen the red eggs of the American Crow. Jacobs finally saw his first clutch of 5 red eggs after more than 50 years of looking and collecting. This particular set was collected in **Pennsylvania**, when “On May first, 1934, my son-in-law, Minor Cole, shot a Crow as she left her nest.” Jacobs described four of them – “The ground color of the other four eggs, originally rich creamy-white, with lavender blendings in paler underlays, is heavily mottled over with brick-red, giving the shells a uniform rich vinaceous [the color of red wine] appearance, over which are diffused blotches of strong vinaceous-cinnamon blending into the underlays.” The shape of the eggs was described

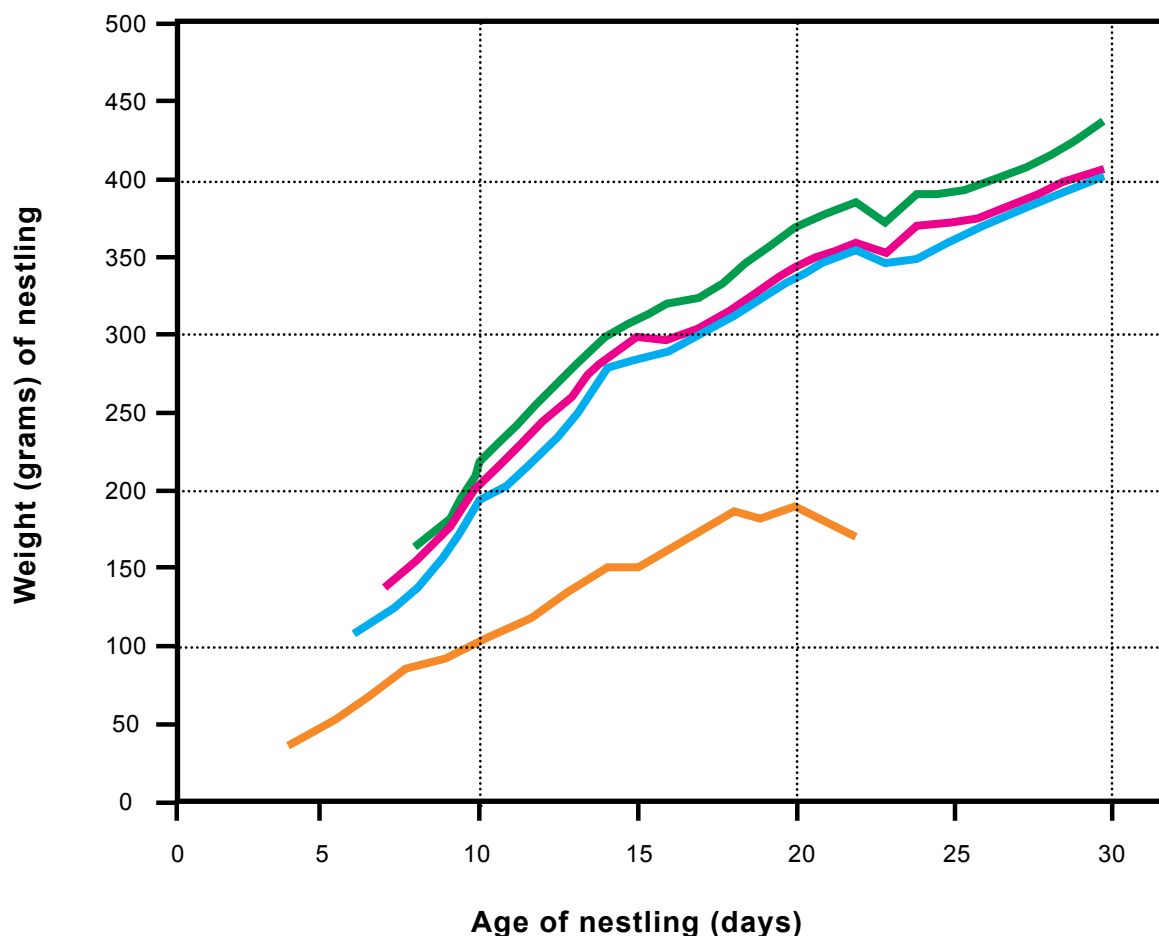
as “rather sharply pointed ovate, of a type approaching elongate” j04.

William Rowan of Edmonton **Alberta** found red (erythristic) eggs in the same nest for seven years in a row g77. Four others had a pinkish buff ground color, over which were minute speckles of fine dots or ecru (the light beige color of unbleached linen) that looked like a heavily marked egg of an American Coot, *Fulica americana* b80.

For normal eggs of crows, the range of color was almost sky blue to greatly blotched with dark green, and the last egg in a clutch was often paler than the rest e40. In a field guide to eggs, nests and nestlings, the crow's egg surface is described as slightly glossy and smooth h36. Emlen says “eggs varied in color from almost immaculate sky blue to heavily blotched dark green” e40.

Burns, in the late 1890s, described sets of eggs from crows in the northern regions – Connecticut, northern New York, southern Michigan, Minnesota and Manitoba, as darker than southern eggs from North Carolina, California, Kansas and Pennsylvania. The northern eggs have a very dark ground color or heavy markings. “The usual markings are in the shape of spots and blotches,





**108.** In this brood of AMCRs in **Ohio**, the lightest of the 4 nestlings did not survive past day 23. The growth of the other 3 nestlings was similar <sup>934</sup>, © E Good and Ohio State University

often so thick as to cover the ground color, usually heaviest at the larger end. Sometimes a set will contain eggs totally unlike in color and markings. Usually the first egg deposited is the most heavily marked and the last egg comparatively lightly marked, often almost spotless. Rarely an egg or set of eggs will be found without a spot or blotch.” Some collectors refer to the latter as spotless blue eggs <sup>2b4</sup>.

Burns ends his paper in 1895 on the American Crow with pages of descriptions of 50 sets of eggs, each usually given by the egg collector. Each description is slightly different. I will include only one description here, by Burns himself, of a set of 5 eggs collected in **Minnesota** by Herman Hershey on 22 May 1892. “**Nos. 1 and 2**, have shell markings of mouse-grey and cinereous,

almost completely overlaid with blotches and longitudinal streaks of olive-green, sage-green, and a few minute markings of clove-brown noticeable at larger ends. **Nos. 3, 4 and 5**. Numerous shell markings of mouse-grey and cinereous, distinct and not overlaid with color; spotted and blotched with olive-green, olive-brown, and clove-brown in larger spots than on the first two eggs” <sup>2b4</sup>.

### Nest defence

This is a lively but brief part of breeding behavior. Within Madison **Wisconsin** and the surrounding agricultural landscape, the type and level of aggression by nesting crows was compared when two people approached a nest with nestlings 1–18 days old. Notes were from 18 rural and 20 urban





nests. The results were not surprising. In the country, where crows do their best work, but have long endured our absurd persecution, the birds were less aggressive in the defense of their nests and young. They kept their distance, and called and dove less often, even when a person climbed to peer into their nest. Self preservation is a strong force. Within Madison crows have nested for decades, and are protected by laws that keep us from shooting them, but not ourselves. In the city, crows were much more used to close encounters with humans that had no severe consequences. The crows did not call or fly off as two researchers neared their nest-tree. However, they did call loudly as a person climbed their nest-tree. The researchers found support for the idea that human persecution of animals alters the animals' behavior. Do crows act like differently because of genetic changes or learning? k86

Other creatures sometimes approach a nest. I have watched crows drive away Blue Jays, grackles, starlings and squirrels from the nest vicinity, starting when an animal was 50–100 meters away. Crows usually gave chase without a sound, while the jays and squirrels uttered notes of excitement. From nest building through to fledging, crows routinely routed other animals. If a squirrel does reach a nest and pokes around in it for a minute or so, this is one sure way of telling the nest you are watching is no longer in use. In late March, with nest-building in an open, tall pine tree nearly over, an Eastern Grey Squirrel, *Sciurus carolinensis*, was almost touching the nest. Suddenly, flashing black wings appeared. The squirrel ran at top speed down the trunk of the tree. Directly behind it, the crow, with equal speed, wove its way between the thick branches. The chase ended just as suddenly at an adjacent shrub on the ground where the squirrel and crow came silently to a stop. An amazing story from near Fullerton **California**. On 22 April 1945, an egg of the Screech Owl, *Otus asio* (\*mean owl's egg is 3.8 x 3.2 cm, Birds of North America online), rested in a clutch of 4 eggs of an American Crow (mean crow egg 4.1 x 2.9 cm, Birds of North America online) being incubated in a tree h11.

[\* Western Screech Owl *Megascops kennicottii*]

Flocks of starlings in April grabbed the attention of a male crow near its nest. Whether feeding



A juvenile Cooper's Hawk perched along the bank of the Assiniboine River. Adults sometimes prey on American Crows

on a lawn or perched in a tree, the starlings scattered as the crow swooped into their midst. From our assessment of the situation, the starlings were eating some food in the lawn that the crow could eat. Or the crow may be searching for prey, trying to catch a starling in flight, or simply having a little fun with the starlings. The chapter on feeding will cover this possibility.

## Incubation

The start of incubation ranged from 8 March to 2 May in **Oklahoma**. The late starts were for second or third nesting attempts. During watches from vehicles in the city of Stillwater, the breeding female spent 83% of her time at the nest. When on the nest she was usually fed by her mate and helpers at a combined rate of every 30 minutes. Helpers, both female and male, fed the incubating female 42% of the time. During feeding visits, crows often lingered at the nest for a short period. Feeding an incubating female on the nest was supplementary, since she often left the nest to feed herself, and preen, etc h06.

A few workers gave a range of 16–19 days





for the incubation period of the crow. Incubation began before the final egg in a clutch was laid. Almost half of the nests checked had warm eggs a day before the last egg was deposited <sup>e40</sup>. Near Saskatoon **Saskatchewan** (lat. 52° N), the mean incubation period was 18 days for 74 nests <sup>i04</sup>. In two different habitats in Cape Cod **Massachusetts** (lat. 41° N), the mean incubation period was 23 (14–33) days for 13 nests. This is well above the average figures from other field workers. Crows at Cape Cod had a total incubation period from 20 March 1984 to 17 June 1985 and 1987. Number of nests incubated by month – March (1), April (16), May (10), and June (2) <sup>c56</sup>. Sterile eggs were incubated by females for up to 28 days <sup>c13</sup>, and 32 days <sup>e40</sup>. In Encino **California** the mean start of incubation was day 90 (84–96), the last day of March, over the five years 1986–1990 <sup>c13</sup>.

CW Crandall found a nest in the fork of a chestnut tree on Long Island **New York**. Something didn't seem right – he could easily see the incubating female crow. He climbed to the nest and “found that by some means, probably a heavy wind, it had become dislodged and had turned almost completely on its side, the eggs just being held in by the rim of the nest. The bird had to sit with one side against the *bottom* of the nest, with the other side exposed” <sup>2b4</sup>.

Northwestern Crows began incubating a four

experiment, the crows abandoned 3 nests after an egg was added. American Crows, in and around Winnipeg **Manitoba**, ejected 21% of non-mimetic eggs, but only 8% of mimetic (resembling their own) eggs. When the 3 abandoned nests were included, the crows ejected 27% of non-mimetic eggs and 21% of mimetic eggs. This indicated they generally accepted one egg added to a clutch while she was laying and then incubating. Crows rejected and ejected mimetic and non-mimetic eggs about equally. At nests where crows accepted both types of an extra egg for up to 5 days, no real eggs went missing <sup>u02</sup>.

Lastly, egg recognition was checked in the two species of magpies in **California**. “In Black-billed Magpie nonmimetic-egg trials, rejection occurred at 100% of nests (n 12).” No other eggs in these 12 nests were damaged <sup>34b</sup>.

Brown-headed Cowbirds, *Molothrus ater*, deposit their eggs in nests of 214 species of birds. Near Buffalo **New York**, a cowbird's egg was found in a crow's nest <sup>f69</sup>. In 1958, George Cotter found a cowbird's egg in a crow's nest <sup>s75</sup>. Then D Hatch found a crow's nest near Oak Lake with 4 eggs and one egg from a cowbird (mean egg size for a cowbird is 2.1 x 1.7 cm, Birds of N. America online). The two latter reports were from **Manitoba** <sup>h43</sup>. These were probably accidental occurrences. It is unlikely the crow would raise a cowbird nestling as its own <sup>f70</sup>.



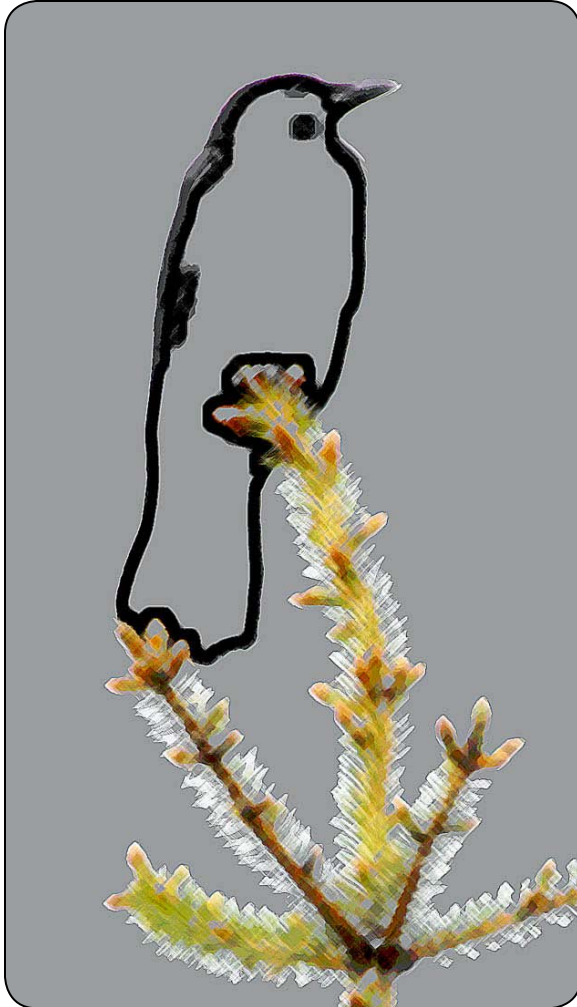
The floating stem of Great Bulrush halts the watery travel of a molted contour feather

or five egg clutch after 2 or 3 eggs had been laid <sup>4b0</sup>. Naturally, asynchronous hatching was the result, with a couple of days required before all the crow nestlings were displayed.

Although American Crows have no history of brood parasitism, they have retained the relic trait of ejecting eggs added to their clutches, whether the new eggs are like or unlike their own. Since nests were visited daily during the duration of the

In the early 1900s, it wasn't known if the female crow was the only one that incubated the eggs. From a collection of 58 crows from western Washington in April and May, the 23 adult male birds had no incubation patch. Neither did male and female yearling crows. It seemed only adult females incubated, and only they had a well-formed incubation patch <sup>j36</sup>. However, while taking external measurements to determine if they





could be used to sex adult crows, it was noticed that 3 of 18 males (17%) had incubation patches, which may have resulted from warming eggs or brooding the young nestlings <sup>c73</sup>.

The incubation patch was explored in 12 families (over 125 specimens) of passerines. In Corvidae, two jays and Clark's Nutcrackers were examined. Only females developed an incubation patch. The patch is not produced by plucking, but by a special molt brought on by hormonal changes during the breeding season. Passerines developed one large incubation patch which underwent an increase in vascularization and other changes to facilitate the transfer of heat from the female's body to her eggs <sup>b13</sup>.

Throughout the night she sleeps on the nest warming the eggs beneath her. During the daytime, she takes short recesses (inattentive

periods) from her incubation duties. At one nest in Guelph **Ontario**, she was on the eggs 90% of the time over nine hours. Twelve bouts of recess averaged 6.5 (4–8) minutes. Three consecutive periods of recess amounted to 6 minutes 45 seconds, 6 min 45 sec and 6 min 40 sec, indicating quite a precise clockwork black. When away from the nest / eggs, she may feed, be fed by him, preen and drink, or help defend the nest. At one crow's nest in **Florida**, there was a 46% rate of nest attentiveness during the first six days of incubation. This increased to 81% from days 7–18. She stayed away for 2–12 minutes at a time <sup>k47</sup>. Among Northwestern Crows on Pacific islands along the coast of British Columbia, she attended her eggs 86% of 147 daylight hours. She enjoyed an average inattentive period of 5.6 minutes based on 65 counts <sup>4b0</sup>. When eggs began to hatch, a nest in **Florida** under observation by Kilham, had 38 visits in one hour by the adult male and helpers. Since the helpers were not bringing food, he thought the nonbreeders' visits were based on curiosity of the hatching process <sup>k63</sup>.

The main activities of the male breeder –

- (1) protect the nesting operation
- (2) feed his mate

During egg laying and early incubation, when the female was receptive to male crows, her mate perched up to 150 m away, quietly watching the nest for periods of up to 30 minutes <sup>k63</sup>. Immediately after being fed she may decide to leave the nest for a few minutes. He may also leave, or linger on the nest's rim, or perch on a nearby branch until she returns. On the outskirts of **Guelph**, a pair of crows had a different strategy. She was not fed on the nest nor did he remain at the nest when she departed. She fed in a open weedy field and accepted food from him during her recesses from the nest. The allofeeding probably helped to reduce her time away from the nest. Nineteen (19) incubating Northwestern Crows were fed by their mates an average of 1.4 times an hour <sup>4b0</sup>. Sometimes a helper may briefly incubate the eggs when the adult female departs to feed <sup>c56</sup>, <sup>v18</sup>. When the eggs hatch, the shells disappear from the nest cup, but it is not known if the adults eat them or carry them away <sup>20b</sup>, <sup>e40</sup>.





When incubating for an extended time without a break, she becomes hungry and starts to beg. A single caw is repeated over and over and over. This caw resembles the begging caw from a juvenile crow in its first summer, but it is louder and somewhat deeper. Her caw is loud enough to help me locate her nest. Kilham heard these calls around egg-laying time and mostly during early incubation. The caas carried up to about 400 m and were given every 3–12 seconds with bouts lasting 30 minutes or more <sup>k60</sup>. The longest bout I timed lasted seven minutes and contained 120 begging caws in a row. In response, a lone crow flew silently to the nest in a pine tree and fed her. Sounds of swallowing were heard. When she produced these begging caws, small movements of the wings and bill were additional clues to the nest's location. Obviously, hunger overrides the possibility of revealing the whereabouts of the nest. Sometimes she flew from the nest to him as he approached with food. In **Florida** her feeding rate was 2.5–4 times per hour by her mate and from 5–7 helpers at 8 nests <sup>k63</sup>. An incubating female on 14 March repeatedly called from the nest. When no crow responded, she flew to an air plant 12 m away and for 2 minutes ate the stored remains of a frog before returning to her nest <sup>k48</sup>.

**A** field in May outside of **Guelph**, I discovered a nest in a spruce tree about 40 m from an elevated road. My position was enhanced because the nest and I were almost the same height, although 50 m apart. She was incubating and so limited in her movements while keeping the eggs warm. One of the things which helped her pass the time was preening. Over 17 hours, preening took place about every eight minutes. Normally less than a minute was devoted to preening, or it filled a block of 3–4 minutes of non-continuous feather touching. The tail, wings, back and chest feathers were run through the bill. If it was raining her head was shaken to dispel excess moisture. An infrequent activity was yawning.

For a moment let's shift our viewpoint. On the street when crows are normally alert, they move their heads side to side in short arcs as they scan their surroundings. In all the bill tip moves through about 300° horizontally with slight up and down shifts. With stopwatch in hand I timed 1,000 head



An exhibition of aspen catkins in early May as some female crows are incubating in **Winnipeg**

movements. A change in bill position took place every 1.2 seconds. When I imitated a crow's head movements with my own head, a refreshing new frame of mind and vision developed. I felt more crow-like.

Returning to the nest being incubated, her head movement rate was greatly reduced. Over 12 minutes her bill shifted position every 8 (1–20) seconds. An extreme lack of head movement occurred when the whitish nictitating membrane closed and she took a nap. Her bill rested lightly on the nest's rim in front of her.

When awake and incubating, she captured a few insects with her bill as they landed on the nest or entered her air space. Besides preening, the most noticeable movement involved rocking back and forth with a side to side motion on the nest. From 87 bouts of rocking, the average was 7 (1–29) rocks, with about six minutes between bouts. She used this rocking movement to obtain a new position or to resettle on her eggs when she returned from the field.

Positional changes during incubation took





place frequently. After a short trip afield, in six of eight cases, she adopted a different position upon returning to her nest. She shifted from a few degrees to a full 180°. In addition to rocking side to side she stood in the nest to quickly shift to a new position on the eggs. Positional changes, 86 of them, including those when returning to the nest, happened an average of every 7 (1–42) minutes. In the rain, she changed position on the nest on average every 14 minutes, or about twice the dry norm. Crow cams will reveal much more.

Within the egg, the development of the embryo in the last few days before hatching in

averages about 280° and the time needed to complete hatching was 6–60 minutes, depending on the species <sup>o19</sup>.

## Nestlings

**E**gg pipping took place about a day before a nestling hatched. Hatching usually occurred in the morning. Most eggs were also laid in the morning <sup>p10</sup>.

Crows in **California** laid 157 eggs, which when fresh averaged 16.6 grams. As the 2.5



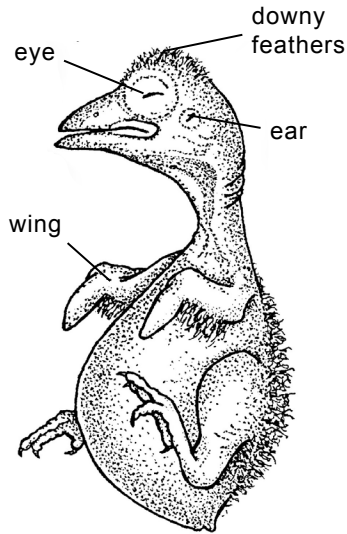
altricial young has been interpreted. The American Crow was not one of the 11 bird species described. However, a few general highlights –

- (1) movements are jerky and convulsive, which later change into more smoothly coordinated movements. The head is lifted out of the yolk sac and tucked under the right wing which covers some or all of the right side of the face
- (2) the head, tucked under the right wing, places the beak and right shoulder in the air space region at the wide end of the egg
- (3) The air space membrane is eventually broken and the chick begins to breath with its lungs
- (4) The first crack (pipping) is made in the egg shell with “strong lifting or back-thrusts of the head and beak toward the shell.” This is generally in the area below the air space. After this first crack it may be a dozen or more hours before the final stage of hatching
- (5) As the tarsal joints are strongly extended into the pointed end of the egg, the head and beak are uplifted against the wide end of the shell. Then the entire body of the embryo rotates counter-clockwise and makes cracks in the circumference of the shell as it moves. The amount of rotation

weeks of incubation passed, eggs lost moisture and weight. Newly hatch crows weighed 12.3 (10–13) grams <sup>e40</sup>. In **Saskatchewan**, an average weigh for 59 newly hatched American Crows was 15.6 grams <sup>i04</sup>. For Northwestern Crows in **British Columbia**, 97 new eggs had a weight of 17.8 grams, while day-old nestlings averaged 14.9 grams <sup>4b0</sup>. Northwestern Crows at hatching weighed a mere 4.5% of the weight they will have when leaving the nest <sup>v13</sup>.

Hooded Crows were weighed and measured in central **Norway**. Complete egg clutches were collected and hatched in an incubator. New hatchlings weighed 13.5 grams, with no difference between the sexes. The yolk sac was about 0.8 grams and was included with the body weights. At hatching, the bill tip length was 5.5 mm, and comprised 24% of the same average measurement of 24-day-old nestlings. It was the most developed external attribute of a nestling. The second was the tarsal length at 10.8 mm, which was 19% of a 24-day-old nestling’s average tarsal length. The middle toe length was also well developed as a percentage of an older nestling <sup>08r</sup>. The reason – when hatching, altricial young extend their legs (tarsi) into the pointed end of the egg to help them





**American Crow** A few tracts of downy feathers adorn a new nestling. The bulging belly holds the remains of the absorbed yolk sac and gizzard. About 2 days old, the nestling was found dead in an abandoned nest in Guelph **Ontario**

push with their head and beak upwards to break free of an egg's shell 019.

Once hatched, there is the human debate over whether parents decide how often each nestling gets fed, or whether their begging signals to a parent their need for food. Mouth color of the nestling may also indicate its need for food. The sex of the nestling may alter the color of the open mouth when begging. In summary, the sound of the begging, open mouth, amount of calling, and movement may indicate to the provider which nestling needs to be fed on the visit.

When I watched the crow cam at a nest on the metal fire escape in **Oregon**, it appeared that among the 4 older nestlings, the one which saw the parent with food arriving, and started to beg first was the one that usually got the food. This would indicated the nestling determined how often it got fed at this stage in its life. Early in the evening, some of the nestlings did not beg when a parent arrived with food, so the parent ignored them in return. A nestling can be facing away from a parent when it arrives with food, but if the nestling turns its head to face the parent and opens its mouth to beg, the



**5 hours** – a 15 gram, altricial American Crow nestling is helpless and needs warmth and food from its parents. It flaunts a few patches of downy feathers 934, © E Good

parent feeds it.

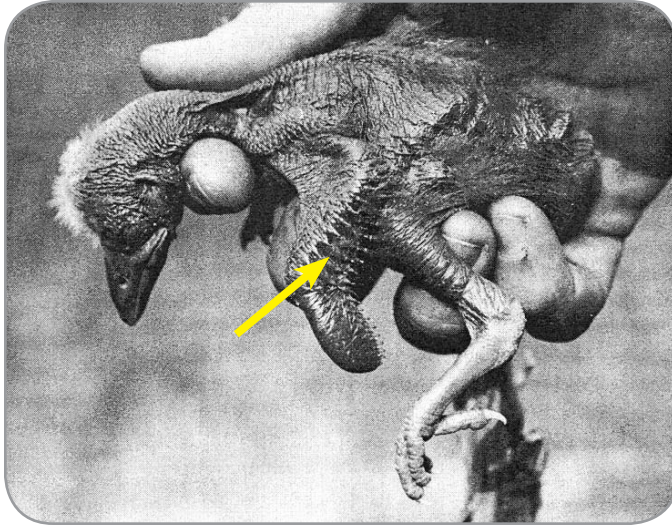
Parmalee removed five nests with partially incubated eggs from trees and placed the eggs in a laboratory incubator until they hatched. The eggs had already been naturally incubated for 8–10 days when removed. Three nests in the field (controls) were visited every 2–3 days to measure and inspect their nestlings. The eggs lost about 1.4 grams per day in the incubator, and the newly hatched crows weighed from 77–82% of the weight of their eggs p10.

I found it interesting that corn mash was injected into Parmalee's experiment. He believed, like many others, the published reports



**Day 4** – more light gray bare skin than feathers in a nestling American Crow 934, © E Good and Ohio State University





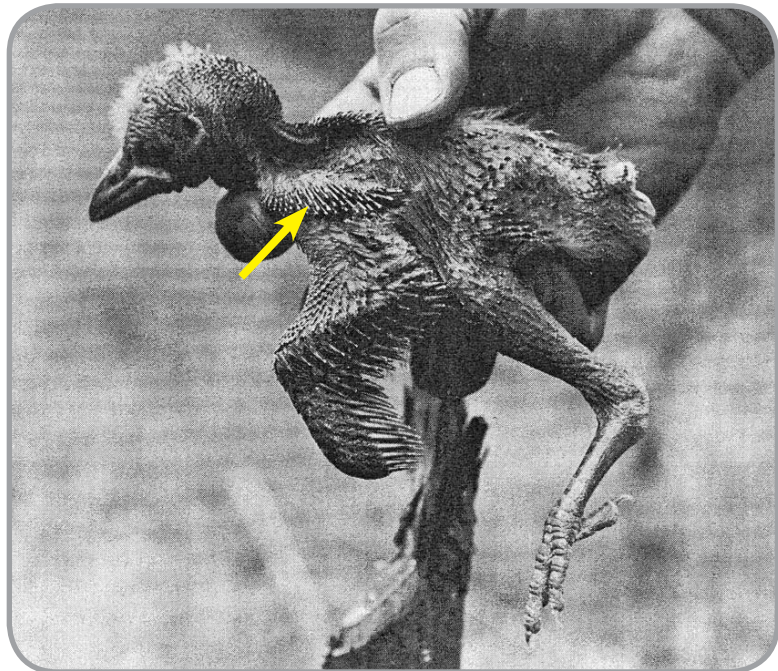
**Day 7** – an American Crow nestling with unopened eyes and unable to hold up its head. The secondary sheaths are obvious 934, © E Good and Ohio State University

that crows ate a lot of sprouting corn (the kernel 5 cm below the ground or leaves above ground?), which apparently forms about 1/4 of the nestlings' natural diet near the time of fledging. [Mice or fish would have been a much better choice for older nestlings]. The amount of sprouting corn they consumed from fields is, I suggest, largely myth. Crows nesting in a city have no corn to eat. Most of the corn eaten by crows is after the harvest in the fall. I have raised a few nestlings to the flying stage and never fed them corn.

Five of 17 laboratory nestling crows in Parmalee's experiment developed problems with their legs, and one bird developed a cross-bill with the lower bill growing to the left. Several young birds harbored the parasitic nematode (*Porrocaecum*) in their small intestine (no more than 3 per bird), probably acquired from being fed earthworms. From 12 pellets regurgitated by nestlings in natural control nests, beetles, grubs and larvae were common ingredients. From nestlings in their last 1–2 weeks in one nest, insect larvae and mice were in their diets as well as grit. [What, no corn?]

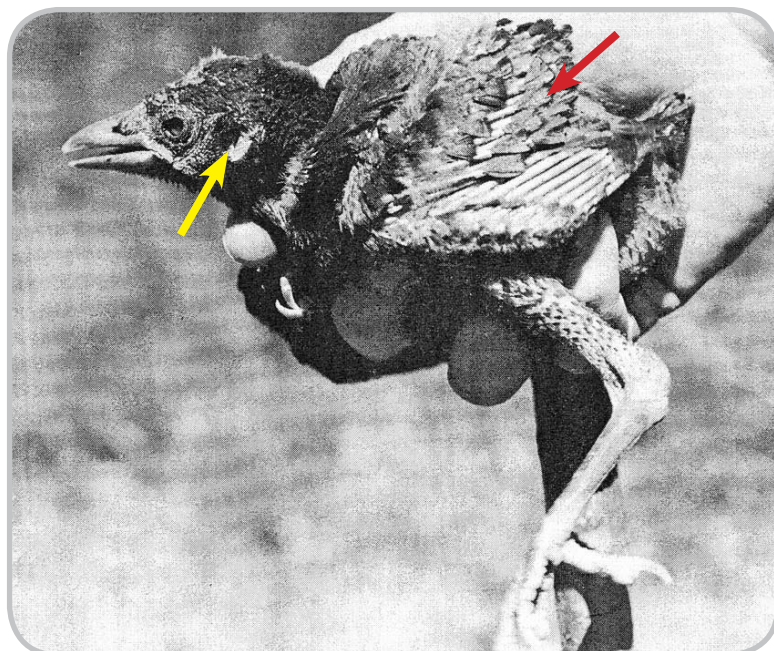
Temperature of the nestlings was about 42 °C when they left the nest. In the laboratory, 3 nestlings from 5–9 days old averaged from 32–36 °C in an ambient temperature of 25–28 °C. At two natural nests, with nest temperatures of 22 and 30 °C, two nestling at 7 and 10 days of age held body temperatures of 35–38 °C. Three indoor nestlings 3 and 5 days old were mistakenly kept too warm at 35 °C during the fifth night and they died over the next 2 days. Parmalee had unexpected problems. Temperature, diet and death plagued his experiments and made the results difficult to follow.

Four nestlings averaged from 284–305 grams at the start and end of a 2-day experiment (11–13 of June 1948). Their food and excrement were weighed (wet) and the difference indicated 60% of the food consumed was utilized by the four birds. Two older nestlings (18 days old) removed from an outdoor nest and fed a diet of bread and milk for 10 days gained little weight. Their large flight and tail feathers elongated, but mostly remained in



**Day 11** – an American Crow nestling is able to keep its head slightly raised. Several tracts of feathers (arrow) are visible on the back and wings. Its skin is dark gray 934, © E Good and Ohio State University





**Day 14** – this AMCR has made it to almost half of its life as a nestling. Its eyes are open, the ear opening is visible (arrow) and the feathers of the secondaries on the wing are erupting from their bluish sheaths (arrow) <sup>934</sup>, © E Good

their sheaths. The umbilical (yolk) scar was gone by the end of the second week, but the shell tooth was still present when the young left their nest <sup>p10</sup>.

Nestling American Crows in **California** develop this way <sup>e40</sup> –

## Integument and feathers

Skin pink for the first 3 days; smoky gray for a few more days; and black by about day 8; pin feathers appeared about day 10 and continued to elongate. Feather growth started about day 15 and continued until fledging at about day 30

## Eyes

Closed until day 8 when slits appeared; started to open day 11–15; at first dull, then becoming clear bluish gray about day 25

## Reaction to observer

Opened mouth (to be fed) to about day 15 or more; crouched in fear from

days 18–27 of age; tried to flee from a person at the nest's rim from about day 25 onward

## Brooded by parents

The first 10–15 days

## Yolk sac persisted

The first 10–12 days

## Voice changed to a lower pitch

About day 15

## Projection of middle primaries past sheaths

Erupted day 16

projected 2.5 cm by day 21

5 cm by day 25

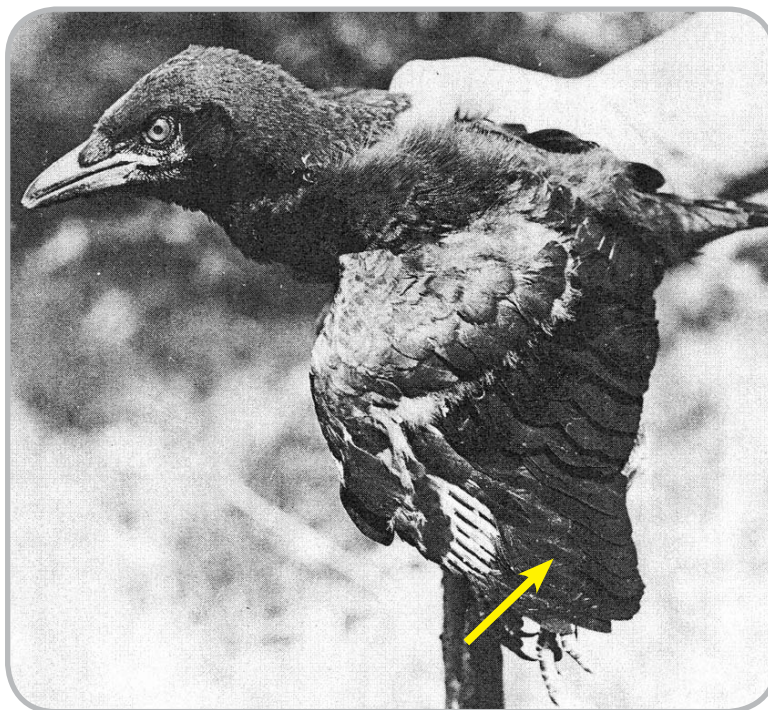
7.5 cm by day 29

## Weight

Day 10 about 100 grams

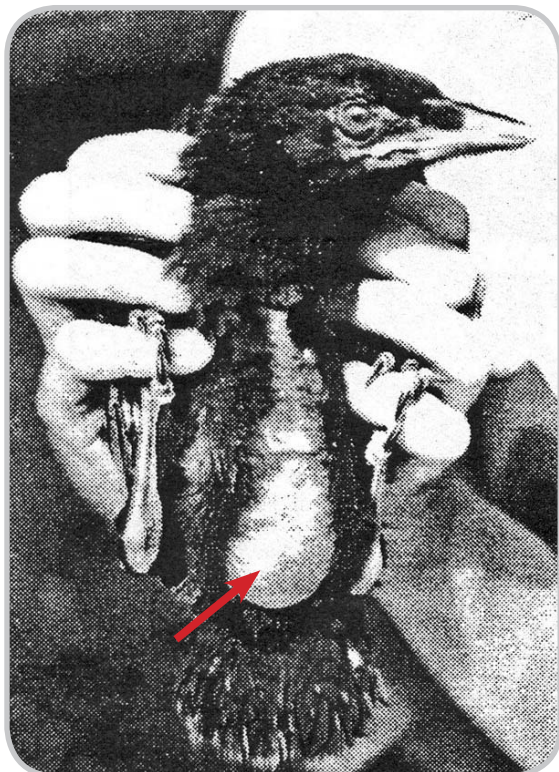
Day 15 about 200 grams

Day 30 about 300+ grams



**Day 21** – the bluish gray eyes are commanding. With the upper body covered with feathers, brooding by its mother is no longer necessary. Flight feathers are extending <sup>934</sup>, © E Good





Although well feathered dorsally (above), the belly of a nestling (about 20 days old) remains bare (arrow). Notice the firm grip by the crow's toes on the fingers of a friend in Guelph **Ontario**

An American Crow about 2 weeks old that was taken from a nest was adopted by Cruikshank. Once flying, it ignored other crows and people, fixating instead on the pair of humans that cared for it. Then it joined Herring Gulls, spending much time with them 52c.

A fledgling Blue Jay (about 30 days old) probably from a nearby nest, appeared in the nest of a Fish Crow, which had nestlings about 5 days old. The jay was fed by the pair of crows and kept warm by the brooding female. It remained at the crow's nest for 12 days, gradually moving from the nest to nearby branches until it finally left. Although a Blue Jay's nest was not located, this appeared to be the most likely avenue of introduction. This was the first instance of one corvid feeding another corvid species at its nest. No aggression was shown towards the young jay m79.

## Nestling dates

**British Columbia** 26 April–11 July (n 103) c31

**Encino, California** 1 April–14 May v18

**Illinois** earliest hatch 6 April, and the first brood fledged 5 May 20b

**Iowa** mean hatching date 29 April (n 73) s33

**Iowa** average hatching date in 1979, 1 May within a period of 25 April–13 June (n 26). Nine of the nests (35%) had their eggs hatch during the first week of May s34

**Maryland** 7 April to 10 June (n 73) 48s

**Minnesota** 10 May–16 June (n 5) r85

**New York state** 1 May–28 July (n 103) 1b3

**Stillwater, Oklahoma** 15 March–3 May v18

**Virginia** 2 April–28 June c69

## A nestling and its feathers

A portrait of a newly hatched crow does not contain the color black. Pink fills the brush – pink for the bill, feet and even the toenails (page 114). Clumps of stringy, gray natal down adorn the top of the head, along the back to the tail, and protrude where the secondary flight feathers will eventually grow. On the flipper-like wings are the

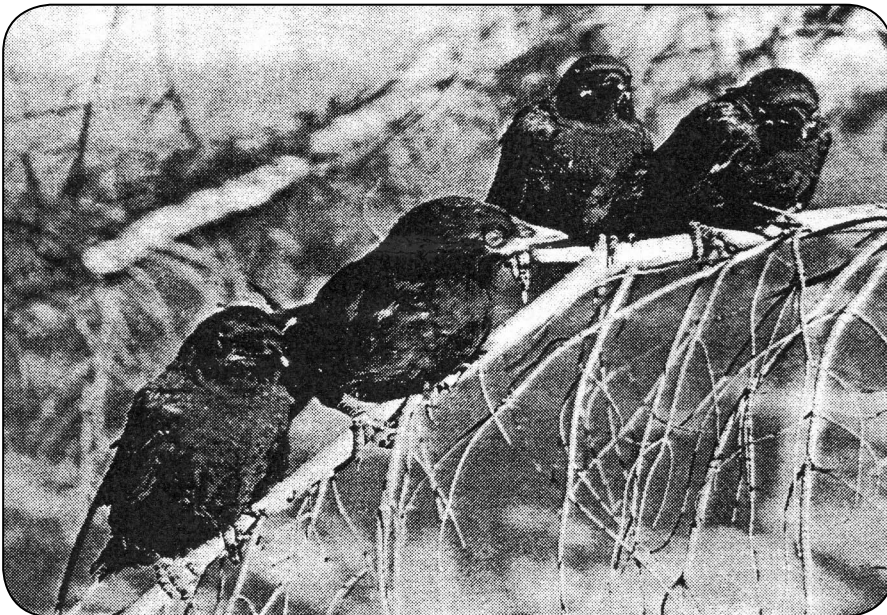


Tarsus 7 days after leaving the nest was unable to fly with its 16 cm wing chord. She could hop with one good foot at least 100 m in 12 hours to keep up with the initial movements of the family. She was killed 10 days after leaving the nest





**Day 25** – Three banded nestlings are very curious about their new world. They can be removed from a nest and easily arranged on a branch for a portrait since they cannot fly. In another 5–10 days they will leave the nest and take their first flight to a nearby tree 934, © E Good



Four unbanded nestlings taken from a nest and placed on a lower branch of their coniferous nest-tree for a portrait in Guelph **Ontario**





initial projections of the 10 primary feathers, and a close look at the tail region reveals 12 tail feathers, each a thin black line about 1 mm long. The ear is represented by a patch of skin 4 mm across with a fold of skin on top. The flap can be raised, but no opening is apparent. Later, at the time of fledging, one crow's ear opening was 6 by 2 mm. A juvenile male crow (6 mos. old) in December 2011 had an ear opening of 9 x 7 mm. For a newly hatched bird, the distance from the tip of the bill to the back of the head was 2.7 cm. In an adult crow the same length was 8.5 cm. The nestling's skull width was 1.5 cm; an adult's width was 3.5 cm. The bulging belly of a newly hatched crow is from the absorbed remains of the yolk sac and its 1 by 2 cm gizzard. In an adult the gizzard was 2.5 by 4 cm. The bill began to harden at day 6 or 7, and the skin color changed from pink to a slate gray over 7–10 days p10.

In the late 1800s, during the early days of pterylography, the study of feather tracts identified 9 regions on a bird's body n30 –

- |             |                    |            |
|-------------|--------------------|------------|
| (1) Spinal  | (5) Lateral neck   | (9) Caudal |
| (2) Humeral | (6) Capital (head) |            |
| (3) Femoral | (7) Alar (wing)    |            |
| (4) Ventral | (8) Crural (leg)   |            |

Clench summarized – “pterylosis varies on two taxonomic levels: minor differences (especially in feather counts) occur among closely related forms, and major differences (primarily in patterns) are seen among higher categories. In a few instances pattern variations appear among well-differentiated subfamilies, but they are most often found among families or groups of families” c82.

The “natal plumage is only a transitory phase of the juvenile plumage” w37. The downy feathers of Northwestern Crows are probably similar to those of American Crows. Verbeek had a close look at the natal feathers of 19 Northwestern Crow nestlings 1–4 days old that were found dead in nests on Mandarte and Mitlenatch Islands, **British Columbia** from 1976–1987. Neossoptiles (downy feathers) only grew on the dorsal side. There were no abdominal feathers. Patagial feathers were found on only 1 of 19 nestlings. With the dead nestlings underwater, downy feathers were



Fledgling named Tarsus. The pads of her toes on the 7 cm long left foot were pinkish gray. Arrow points to right tarsus without toes. Photograph © by Anne Adkins, 4 June 2011, **Winnipeg**

examined under a dissecting microscope for – distribution over a nestling's body, arrangement (rows, clumps), number in each of 15 regions in 6 tracts, and their lengths.

The total number of downy feathers averaged 366 (330–416) per nestling (n 10). The 5 largest in number and length were v12 –

#### NUMBER (Northwestern Crow)

Tract	Region	mean (range)
Capital	Coronal	37 (28–55)
Spinal	Pelvic	36 (33–42)
Femoral	na	23 (18–28)
Scapular	na	21 (18–27)
Spinal	Mid-dorsal	17 (14–22)

#### LENGTH (Northwestern Crow)

Tract	Region	mean (range)
Spinal	Mid-dorsal	11 (8–13) mm
Femoral	na	9 (7–11) mm
Spinal	Pelvic	9 (6–12) mm
Scapular	na	8 (6–11) mm
Gsc*		8 (6–8) mm

\* Greater secondary coverts





Semiplume – total length 11 mm, removed about 2 cm from the notch under the lower bill of a dead Tarsus

Weatherbee looked at 5 nestlings of the American Crow. His total average count was 358 downy feathers. As above he found w37 –

**NUMBER (American Crow)**  
**Region mean (range)**

Spinal	58 (52–63)
Coronal	30 (21–44)
Femoral	23 (18–26)
Scapular	18 (11–22)
Occipital	13 (7–16)



Developing under tail covert taken from a dead Tarsus. Total length 5.6 cm by 4 cm wide; quill was 1.6 mm wide, bluish and soft



Curved growing nostril bristles from a dead Tarsus. The sheaths of the bristles are 5–7 mm long





Tarsus, a malnourished crow, rests on a low coniferous branch in **Winnipeg** for her portrait. The blue eye, a delightful feature of nestlings and young juveniles, will turn brown in a few months to match the iris in an adult's eye

#### LENGTH (American Crow)

Region mean

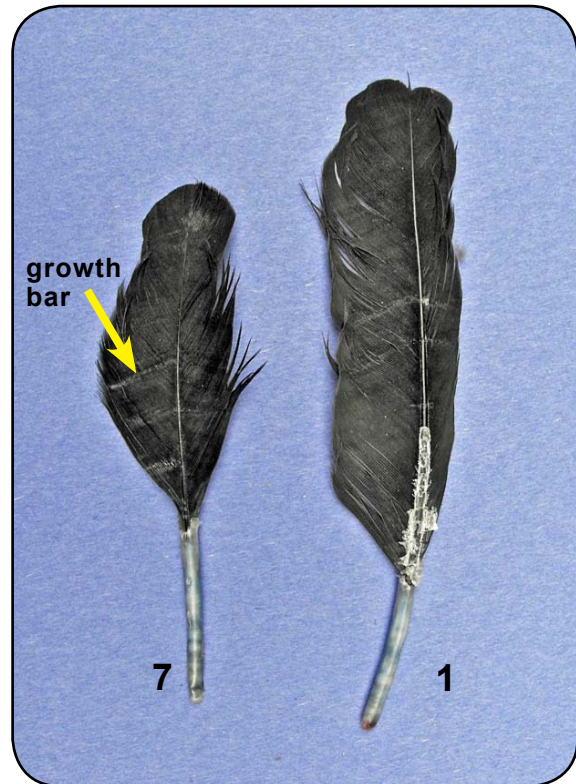
Spinal	16 mm
Femoral	12 mm
Scapular	12 mm
Gs coverts*	11 mm
Coronal	07 mm

\* Greater secondary coverts

Two additional newly hatched American Crows were checked and it was confirmed that 5 neosoptiles were present on the ocular region of one specimen w38. The feather tracts of American Crows appeared under the skin of nestlings at 6–7 days of age, and at 10–12 days of age, feathers of the four tracts listed below broke through the skin p10.

- (1) **alar** wing, dorsal and ventral feathers
- (2) **humeral** shoulder
- (3) **spinal** dorsal region from the skull's base to the tail bone or pygostyle
- (4) **ventral** from the notch of the lower bill to the feathers around the cloaca region

Both the caudal (tail feathers, and dorsal and ventral tail coverts) and abdominal sections



Growing secondaries from a dead Tarsus (11 June); # 1 is 12.7 cm (total length); # 7 is 10 cm (total length of quill and vane) by 3 cm wide; the blue sheath / quill was 3.4 cm long. In an angled light, growth bars (arrow) are obvious on vanes

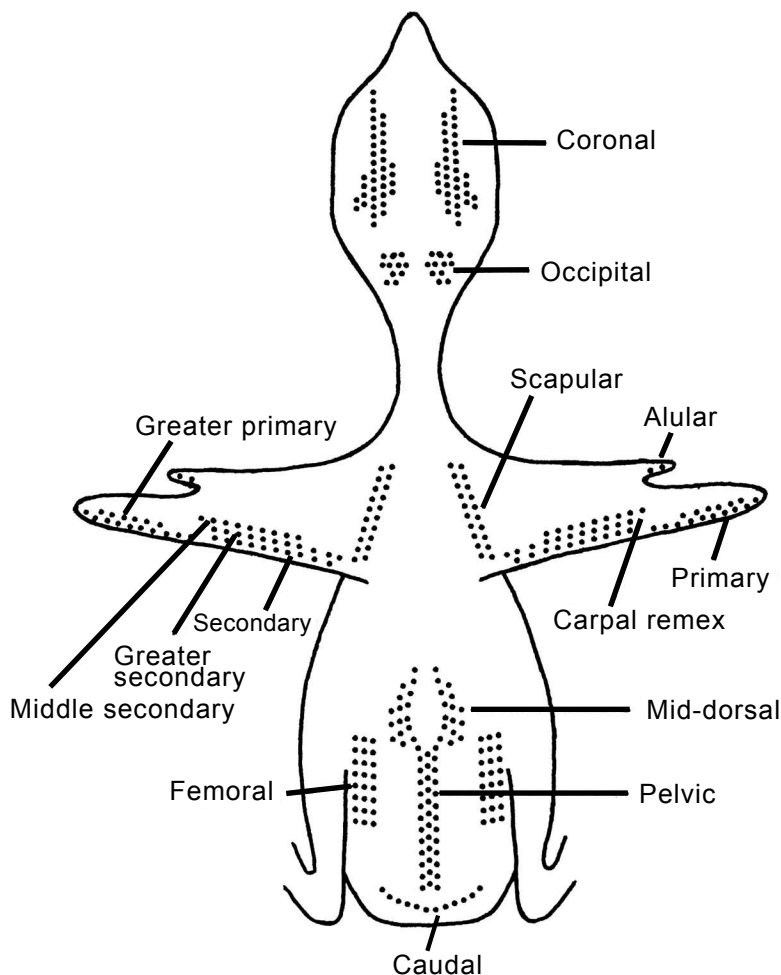




of the ventral tracts were slow to develop, which explains why the belly region of a nearly fledged nestling is bare. It is the part in contact with the nest cup.

Tarsus (wing chord 16 cm), the malnourished nestling that fledged in early June when her

ascending, very fine and 0.2–0.5 mm long on each side of a barb. The barbules are well spaced and not interlocking among themselves, or with adjacent barbules. Consequently, semiplume feathers have a fluffy appearance and little rigidity.



**122. Northwestern Crow**, *Corvus caurinus*, in a dorsal view with an average of 366 downy feathers in 14 areas. Each dot represents a single feather v12,  
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nest mates did, had black nostril bristles 12–13 mm long which included a thin flattened grayish sheath 5–7 mm long with a width of 0.5 mm near its base.

From the top of the head of Tarsus, two semiplumes are pictured on [page 123](#). The rachis was 0.1 mm thick, black and hairy. The black barbs are alternate, ascending, and 0.5–1.2 mm apart along the rachis. The barbules are black,

Emlen provided an outline for the development of juvenile feathers on nestlings of American Crows e40 –

**Pin-feathers** appeared about day 10

**Brushes** about day 15

**Primaries** 5, 6 and 7 on day 21 protruded about 2.5 cm past the ends of their sheaths





Large wing and tail feathers, and those of the spinal and ventral tracts, were enclosed in sheaths until the bird was about 7 days from fledging. Then the sheath broke from a combination of feather growth and preening by the large nestlings. The primaries and secondaries broke through the skin on days 10–12, or about the time the eyes began to open. Between 15 and 17 days of age, semiplumes and body contour feathers appeared on the legs, back and sides. Sometimes, the bare abdomen was not covered until the bird was ready to fledge from its nest <sup>P10</sup>.

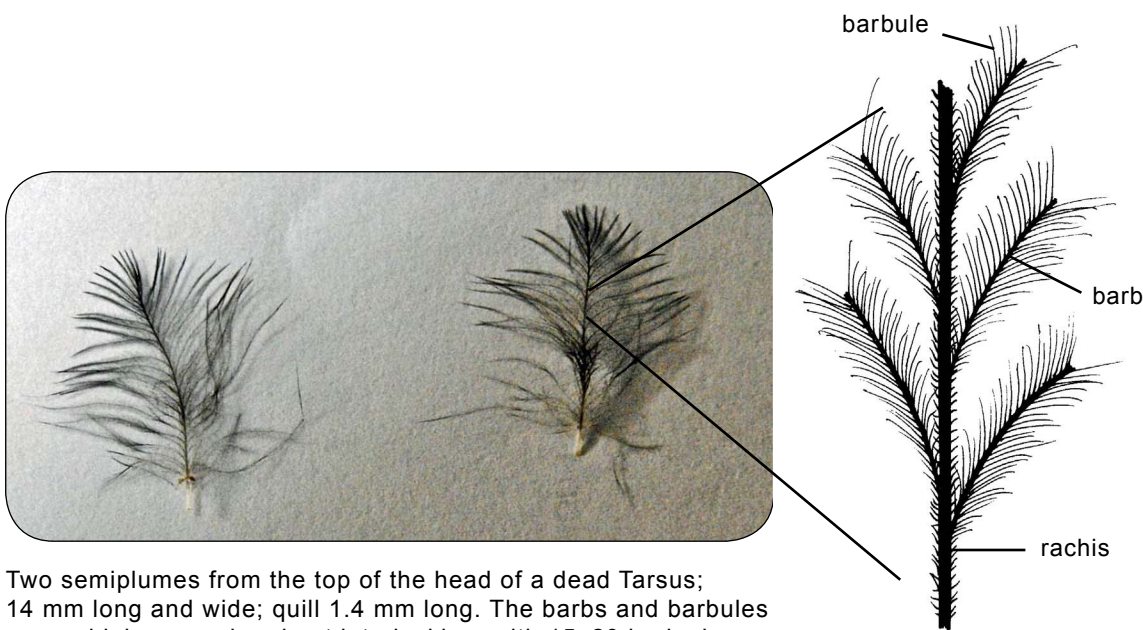
## Thermoregulation

Body temperature and thermoregulation of the Northwestern Crow in **British Columbia** will suffice for now. First a definition of **effective endothermy**. It is the age at which a nestling in a natural nest, not in a laboratory, achieved thermoregulation and was not brooded by the adult female in order to maintain its internal fire. The time to reach thermoregulation by altricial nestlings in 22 species did vary. The timing among species was related to growth rate, body size, actual length of time as a nestling, rates of feather

growth, nest insulation and wind direction, number of nest mates, color of skin and feathers, climate, amount of sunshine on the nestlings and their movement into sunshine. Some nestlings can thermoregulate in a brood situation a few days before each one attained the ‘physiological’ age of endothermy, which involved staying warm for an extended period in moving air of varying ambient temperatures <sup>d71</sup>.

From 77 Northwestern Crow nestlings in 27 nests on Mitlenatch Island in the Strait of Georgia **British Columbia**, temperatures were obtained with a quick-reading thermometer inserted into the mouth <sup>v13</sup>. An adult crow’s body operates at 40–42 °C. Two other researchers gave 41.5 °C for the American Crow <sup>b25</sup>. While investigating blood parasites for the American Crow in Dunville **Ontario**, the body temperature of a crow was monitored. It was the lowest about midnight (40.5 °C) and the warmest (42.2 °C) at 3 PM <sup>m02</sup>.

Through the first 5 days of life, Northwestern Crows were brooded 93% of daylight hours. For nestlings 16–18 days old, she averaged an 18% rate of attentiveness <sup>4b0</sup>. When 47% of the 32 day total nestling period (days 15–17) was over,



Two semiplumes from the top of the head of a dead Tarsus; 14 mm long and wide; quill 1.4 mm long. The barbs and barbules were widely spaced and not interlocking, with 15–20 barbs less than 0.1 mm wide on each side of the central black rachis. The barbules were from 0.5–1 mm long and ascending. They were shorter near the tip of the feather and near the tip of each barb. My ink drawing (x20) is from the central area of the hairy rachis





Region	Length (mm)	Number Average (range)
Coronal	7	30 (21–44)
Occipital	5	13 (7–16)
<b>Spinal</b>	<b>16</b>	<b>58 (52–63)</b>
Scapular	12	18 (11–22)
Femoral	12	23 (18–26)
Retrix	3	12 (12)
Primary	2	10 (10)
Secondary	4	11 (10–11)
Greater primary covert	2	8 (7–10)
Greater secondary covert	11	11 (10–11)
Middle secondary covert	7	8 (5–9)
Carpal remex covert	2	1 (1–1)
Alula	2	2 (2–3)
Patagila covert	3	0 (0–2)

**124. American Crow** The spinal neossoptiles are the longest and most numerous of the 14 regions w37, © Amer. Mus. Nat. History, NY

the nestlings had reached the age of effective endothermy. From days 4–17, nestlings gained 16–17 grams a day, and by day 12 had reached about half of their fledging weight v13.

At one day of age, within one minute of being taken from its nest, a Northwestern Crow nestling had a body temperature averaging 34.3 °C. The body increased its internal temperature at the rate of 0.3 °C per day to about 40.2 °C on day 17, which is almost an adult's body temperature. When kept outside the nest for 21 minutes, a day-old nestling maintained its temperature on average 9–10 °C above the ambient air temperature. At 22 days of age, 7 nestlings held a body temperature of 39.8 °C after 21 minutes out of their nest in the field. Nestlings crowded in the nest cup helped to maintain their body temperature v13.

Aleksiuk studied the adaptation of the temperature-dependent enzyme, malate dehydrogenase in the metabolic activity of the American Crow and pintail. Enzymes are protein

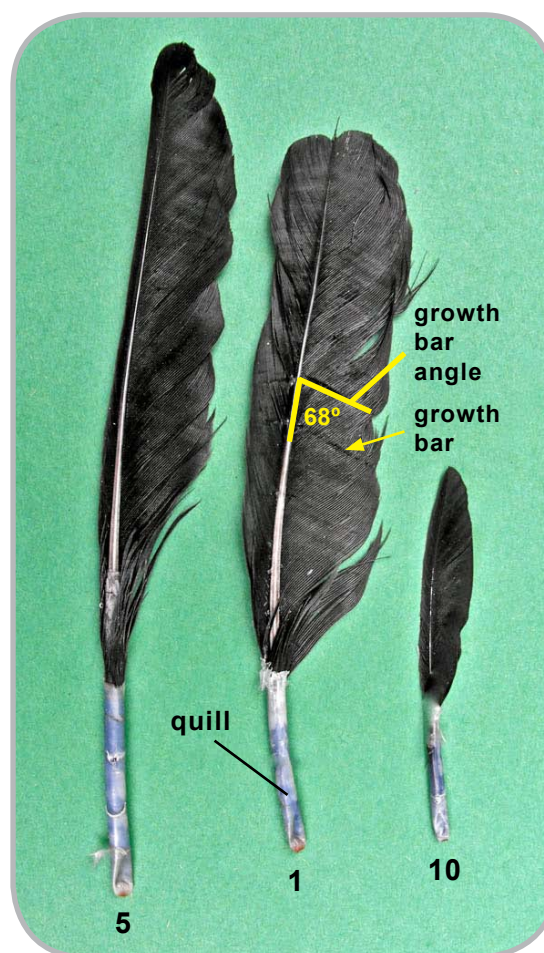


Three juveniles, in dull gray plumage, work on their relationships with each other a few weeks after fledging from their nest; 28 June 2011 in a park in **Winnipeg**





molecules that act on target molecules of the substrate and are transformed into products. When crows hatch, they are called poikilotherms (unable to maintain or regulate the temperature of their body). The adult female crow (a homeotherm) broods her nestlings for about 2 weeks to protect and keep them warm. As the nestlings began to grow, their constructive metabolism (synthesis of proteins, carbohydrates, and fats that form tissue and store energy) worked best within a certain range of temperatures. The effect of temperature on the kinetics of malate dehydrogenase in nestlings and adult crows was investigated. The enzyme was extracted from the liver's cytoplasm (material or protoplasm within a living cell, excluding the nucleus). Starch gel electrophoresis was used to examine the isoenzymic patterns of the malate dehydrogenase. The activity of the enzyme was followed from the oxidation of nicotinamide adenine dinucleotide (NADH). Malate dehydrogenase catalyzes the reversible oxidation of malate to oxaloacetate, utilizing the NAD/NADH cofactor system in the citric acid cycle. The electrophoretic mobility of the two isoenzymes (each of two or more enzymes with identical function but different structure) migrated to opposite electrical charges + and -. Aleksasuk found the mobilities of the isoenzymes in the nestling crows were different than those of adult birds. And temperature had a noticeable effect on the Michaelis constant ( $K_m$ , is a measure of the efficiency of an enzyme in converting substrate into the end product). For the crow, a drop in temperature from 45–15 °C resulted in a 3-fold decrease in the  $K_m$  value. Minimum  $K_m$  values existed between 5–15 °C and the maximum levels at about 41 °C, which was close to a normal adult's body temperature. In the adult crow, the maximum level of enzyme activity was reached between 35–40 °C, while at 5 °C about 26% of the maximum activity was retained. However, in a nestling crow, a plateau of



**Tarsus** Growing wing feathers (primaries) removed 11 June 2011; primaries 5, 1, and the 10th (outer short feather 6.5 cm long – total length of vane plus soft blue quill). The #5 primary was 15 cm long

activity operated from 30–40 °C and at 5 °C, 32% of the maximum was maintained. The adaptive significance for an altricial crow nestling was an increase in enzyme-substrate affinity during a decrease in temperature which counteracts the negative effect of decreasing thermal energy on enzyme catalysis. The stabilization of reaction rates from 30–41 °C in nestling crows, especially in northern areas like **Winnipeg**, was certainly beneficial for growth. A look for age-specific isoenzymes in altricial nestlings is the next step, and relating these changes to the temperature regulatory abilities of growing nestlings a12.

## Global warming

This controversy allowed some people to develop





computer models dealing with the advent of increased effects of drought and heat on the avian community. Nesting / breeding and juveniles are the first concern with juveniles predicted to experience the largest decline for some species from 100-year extreme weather events a06.

Nesting initiation dates of the Mexican Jay in **Arizona** in relation to global warming was noted from 1971 to 1998. The day of the first nest in the jay population and the date of the first clutch both were earlier at the end of the 27-year study by 10–11 days 96b.

## Nestling's body development

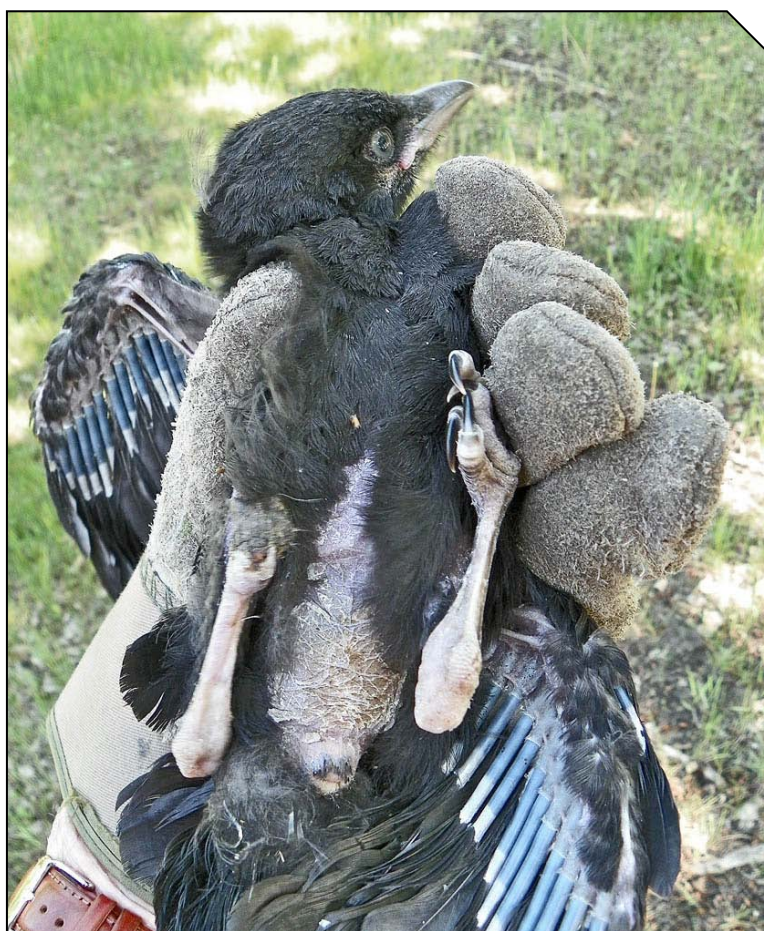
For the first two weeks, as a nestling's feathers grow and its body weight increases, brooding is almost continuous e40. However, from about 10.5 hours of observation at three nests, her brooding routine for 2–6 day old young (average temperatures in **Florida** in March are in the mid-20s) lasted an average of 20 minutes on and 25 minutes off (recess). Beyond two weeks, she left the nest for longer periods when she fed herself and acquired food for her charges 20b. Brood attentiveness was related to the size of the brood. For instance, she brooded 5 nestlings for 9 days and two nestlings for about 21 days k63.

Sight for a nestling arrives slowly. Crow watchers cite varying dates of development. The eyes are closed at hatching, but by day 9 a slit has appeared, and at day 13 the opening was usually complete. The gray-blue hue was not obvious until the 18th day, which coincided with the initiation of the crouch or fear reaction of nestlings towards people peering into the nest e40.

In other studies, nestlings developed fear of humans on days 13–14 as the primary feathers started breaking from the sheaths. The eyes were fully open about day 11. Nestlings 10–11 days old were not brooded by the female 20b. The eyes of nestlings started to open,

but were only slits at 5 or 6 days of age. By 20 days in the nest, the iris of the eyes appeared blue-gray 975. Eight nestlings' eyes began to open on days 10–12, but as early as day 6 for one nestling. On day 10, nestlings weighed about 60 grams p10. Kilham heard the first sounds from nestlings at 4 days of age k63. In a 5-day-old nestling, the yolk sac was about 8 x 10 mm, then reduced to about 3 x 6 mm in a 10-day-old nestlings e40. Northwestern Crows began to open their eyes at day 5. By the 9th day the eyes were fully open and the iris blue. About day 12, young crouched in the nest and showed less enthusiasm in begging from people. About this time, the female Northwestern Crow began to help her mate gather food to feed the nestlings 4b0.

From their featherweight beginnings, nestlings of American Crows grew to a weight of 330–415 grams before departing from the nest. The



The underside of Tarsus is a week or more away from being covered by feathers





Young fledgling taking a mid-day snooze on the branch of a conifer near its nest-tree in **Winnipeg**. The dark gray juvenile body feathers lack sheen and will be molted over the first summer. The secondary wing feathers have a faint bluish sheen

weight of eleven, 30-day-old nestlings averaged 380 grams, where the average age of fledglings was 32 days i04. Nestling growth takes 30–35 days e40, 4b0. Black however, found 27 days was the length of nest-life for crows in **Illinois**, and the majority of young fledged from the nest in May, a month earlier than in Winnipeg. The plotted growth rate produced a standard ‘S’ curve 20b. From the 8th to the 18th day, American Crow nestlings achieved their maximum gain of about 18 grams per day. The weights over 5-day increments were e40 –

<b>day 1</b>	12 grams	<b>day 15</b>	210 g
<b>day 5</b>	40 g	<b>day 20</b>	270 g
<b>day 10</b>	115 g	<b>day 25</b>	290 grams

Another passage described the incremental growth of nestlings’ feathers. The average amount of feather protruding beyond the opaque blue sheaths for the 5th, 6th and 7th primary wing feathers was e40 –

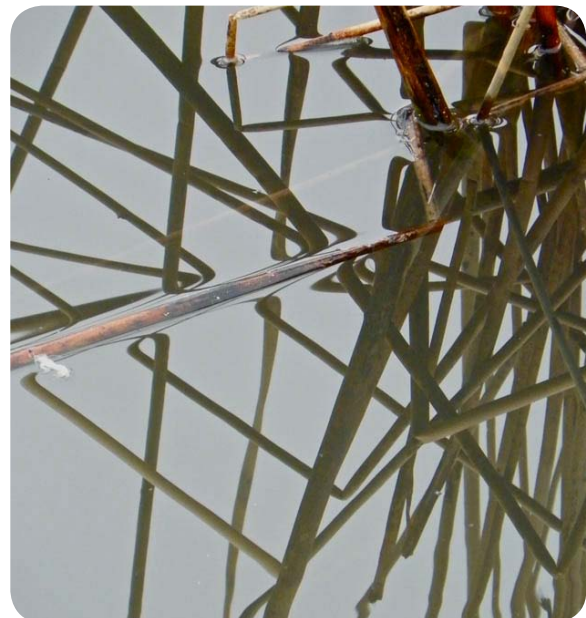
<b>day 21</b>	2.5 cm	<b>day 33</b>	10.2 cm
<b>day 25</b>	5.0 cm	<b>day 38</b>	12.7 cm
<b>day 29</b>	7.6 cm	<b>day 44</b>	15.2 cm

About a week before leaving its nest, a nestling may acquire a # 5 size metal leg band.

a colored plastic leg band, if it happened to be involuntarily involved in a researcher’s project. A tiny amount of a nestling’s blood is used to identify its sex. A radio-transmitter may be attached to the back or tail to track its every move once it left (fledged) from the nest-tree.

For nestlings of Northwestern Crows in **British Columbia**, the bluish white sheaths of primary wing feathers first emerged on day 9 from the skin. Other feathers closely followed. From days 14–27, the period of fastest growth, primary #1 lengthened an average of 7 mm a day. When nestlings weighed 178 grams on day 13 (57% of fledging weight and 46% of their average adult weight) the first primary emerged from its sheath. Primaries reached their brush stage about the time nestlings had lived 42% of their lives as nestlings v13. Fledglings often left their nest before they could fly. Some died in this early stage. At the other end, because of asynchronous hatching dates, nestlings in their first week of life experienced the highest rate of mortality from starvation i04, or weather conditions c56.

In May, Carrion Crow nestlings, 5–11 days old were taken from their nest in southwestern **Switzerland** and placed in a laboratory. One control group always had food available; the other experimental group had their food intake



Great Bulrush – reflections on a cloudy day





American Crow fledgling with bluish-gray eyes is perched in a Cottonwood

restricted. When the marked birds were 50 days old they were sexed and transferred to an outdoor aviary where food was plentiful for all the birds. Interactions among the birds were observed to decide which were dominant. Relatedness was not considered important when the interactions were analyzed.

The larger, well fed birds had a higher ranking than birds on the earlier restricted diet. Females of the latter group were the lowest ranking. Within each family, the larger males dominated the females, and for birds of the same sex class, the larger ones were the dominant birds. Nestlings on a restricted diet “reached a significantly lower final weight much later than did the faster growing nestlings of the control group.” The underfed nestling Carrion Crows, with a slower growth, extended their weight gain over a longer period. However, the growth of the tarsus showed no such compensation. It grew normally. For both groups, tarsal growth was finished when a nestling fledged. Body weight and size can influence the ranking and status of a crow which in turn

affects its life <sup>r63</sup>.

During the 1990s, McGowan banded, measured and weighed 28-day-old American Crow nestlings in Ithaca **New York** (suburban) and the nearby country (rural). At this age the tarsal length was equal to the average length of adult crows and suitable for banding <sup>m85</sup> –



Portrait of Tarsus – 2 days out of the nest





### **SUBURBAN CROWS** (means of 143 nestlings)

Bill (nares to tip) 2.3 cm  
Tarsus length 5.9 cm  
Tail length 6.6 cm  
Weight 367 grams

### **RURAL CROWS** (means of 38 nestlings)

Bill (nares to tip) 2.4 cm  
Tarsus length 6.1 cm  
Tail length 7.2 cm  
Weight 411 grams

In the drought year of 1995 at Ithaca, nestlings appeared less perky compared to normal years, and it seemed breeding pairs abandoned more nests after they were visited by researchers m85. As well, nestling crows in the city were slightly smaller in the above four measurements, which he attributed to a reduction of available invertebrates. Yet, overall, suburban American Crows had a slightly higher nest success, but with fewer and smaller young than their rural cousins on nearby farms.

Later, in and around Ithaca **New York**, the growth and nutrition of American Crow nestlings was studied. For nestlings 23–31 days old, 5 of a total of 12 average measurements taken over a 3-tier gradient from city to country were h66 –

### **FEMALE** (means in city / country)

Tarsus length 5.6 / **5.9** cm  
Wing chord 17 / **16.8** cm  
Seventh primary 11.3 / **11** cm  
Tail 6.3 / **5.9** cm  
Weight 334 / **377** grams

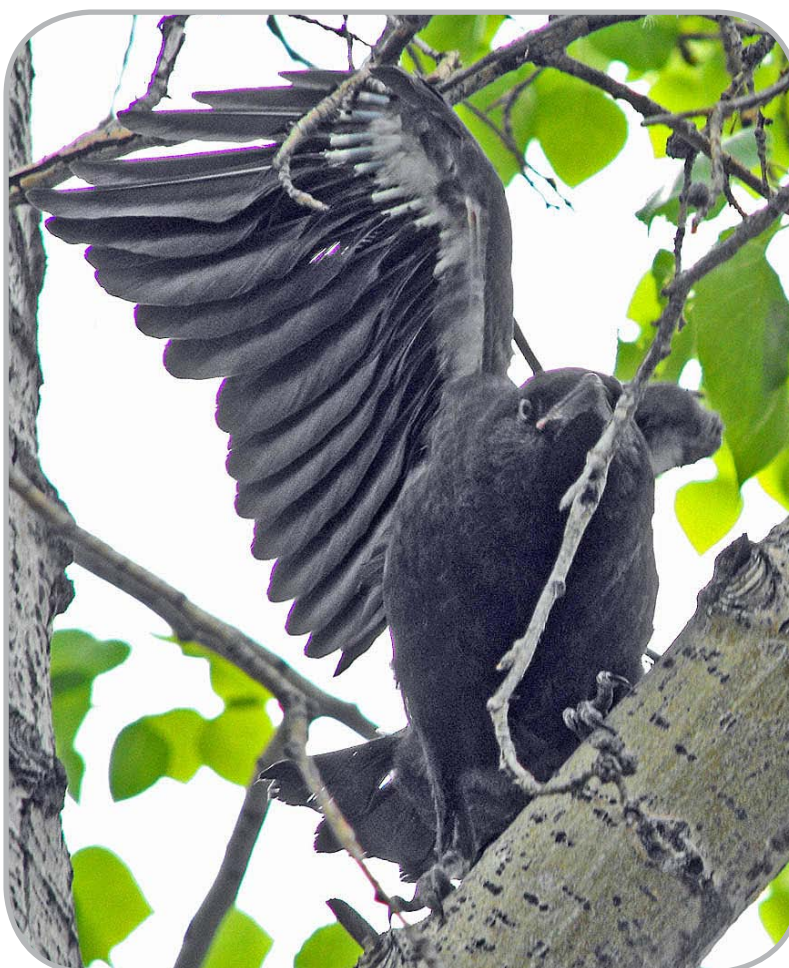
### **MALE** (means in city / country)

Tarsus length 5.7 / **6.1** cm  
Wing chord 17.4 / **17.7** cm  
Seventh primary 11.7 / **11.5** cm  
Tail 6.1 / **6.4** cm  
Weight 352 / **410** grams

The figures above include only the smallest average for the 2 urban gradients. Rural nestlings were larger than suburban nestlings. The urban nestlings, however, received enough calories from the junk food their parents sometimes fed them.

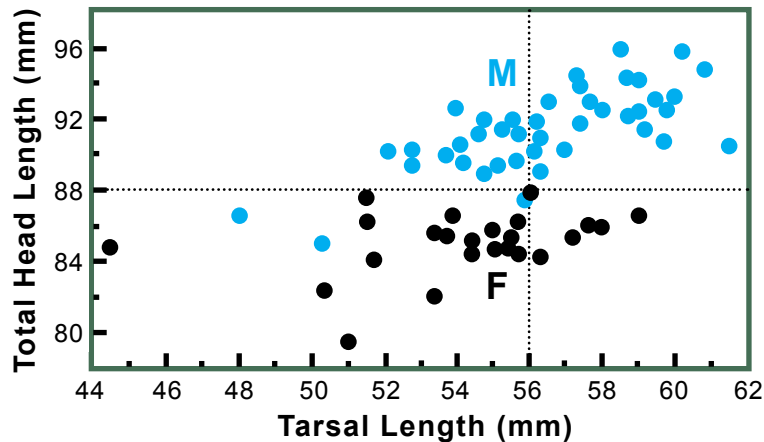
Compared to wing feathers, the legs of nestlings grow rapidly. In the Northwestern Crow, the tarsal length reached the adult length of 5 cm by 16–18 nest-days 4b0. Now they could stand high enough and defecated over the edge of the nest. Closely following the growth of American Crows, at day 9 the nestlings were able to retain the # 5 leg band – the standard size for adult American Crows 20b.

Continuing, nestlings of the American Crow



Newly fledged crow (3 days out of the nest) stretches its wings while perched in a Cottonwood. It is covered with the dull gray juvenile plumage (from a prejuvenile molt) acquired in the nest. The wing and tail feathers will grow for another month. Its nest is 10 m away in a Colorado Spruce





**130.** For American Crows older than 2 months post fledging, the males (M) have a longer tarsal and head length than the smaller females (F) c09. The small amount of overlap prohibits the use of these 2 measurements to perfectly sex crows, © American Ornithologists' Union

near fledging size were measured and poked for blood to determine their comparative health in an urban versus a rural habitat. Although brood size and feeding rates did not differ between the two habitats, rural nestlings were larger over many of the measured parameters. Plasma calcium and protein levels were substantially higher for nestling crows in the country h66.

Are adult crows in the city becoming smaller than crows raised in the country? Perhaps a crow in the city should be slightly smaller and more agile to avoid the numerous obstacles – wires, vehicles, bicycles, trees, signs and buildings, which interfere with flight. A rural crow's nest in a hedgerow is probably surrounded by open farmland. Leg and wing injuries are noticed every year among urban crows. Does the percentage of injured birds differ between the two habitats?

In a somewhat different context for the North-western Crow, at day 20 the tip of the longest primary feather extended beyond the tips of the tail feathers. Behaviorally, this coincided with some nestlings moving onto branches near their nest 4b0. By comparison, tail feathers of adult crows extend 1–2 cm beyond the longest primary feather. From two different nests in **Guelph**, two American Crows captured on the ground shortly after they fledged had similar wing chord lengths of 21 cm but dissimilar weights of 350 and 260 grams. When one considers an adult's wing chord is 29–32 cm long, the above two fledglings had considerably less wing area.

In the parklands near Saskatoon **Saskatchewan**, 22-day-old nestlings were banded and measured. Brood sizes were 1–4 birds, with 3 the

most common number of nestlings at four groups of nests in rural areas. Statistics on 115 nestlings varied according to brood size. I have combined all the measurements to provide range extremes i04 –

#### Nestlings (22-days-old)

**Bill length** 1.85–2.3 cm (inside the outer edge of the nare [nostril] to the tip of the bill)

**Head-bill length** 6.6–7.7 cm (occipital ridge at the back of the skull to the tip of the bill)

**Weight** 280–407 grams

Nestlings at hatching measured 2.3 cm from the tip of the bill to the back of the skull. This length increased to about 8.6 cm at time of fledging for some crows p10.

Climbing trees to measure and band nestlings exposes the climber to the wrath of parental crows that do their best to protect their young from human intruders trying to gain information. In Stillwater **Oklahoma**, one male field assistant climbed to a crow's nest near the top of an 18 m tall pine tree. First the parents called loudly to alert other crows in the area, then they began diving to within 3 m of the young man. Finally, the female breeder twice broke off a pine cone and dropped it onto the climber's head c14.

**W**hen banding older nestlings, it is important to sex them. A rather simple DNA blood test determines avian sex. The male birds have two identical sex chromosomes (ZZ), and the females are heterogametic (ZW).





This difference was the basis for the test h22. Additional genetic work identified 11 microsatellite loci with polymorphism at these loci of from 4–43 alleles. Using these markers, genetic parentage helped to explain some of the behavior of crows based on the relatedness of the crows around them s40.

DNA was gathered from a variety of feather types from Northern Goshawks. Using a modified method, which took more time but resulted in much higher yields of DNA, molted tail feathers produced the highest yield compared to primary, secondary and smaller feathers d41.

Toe pads of nestlings are soft to touch and a light gray in color. Daily wear toughens and dark-

ens them. Road-killed crows I checked, mainly from June through August, were juvenile birds that still retained soft, light toe pads.

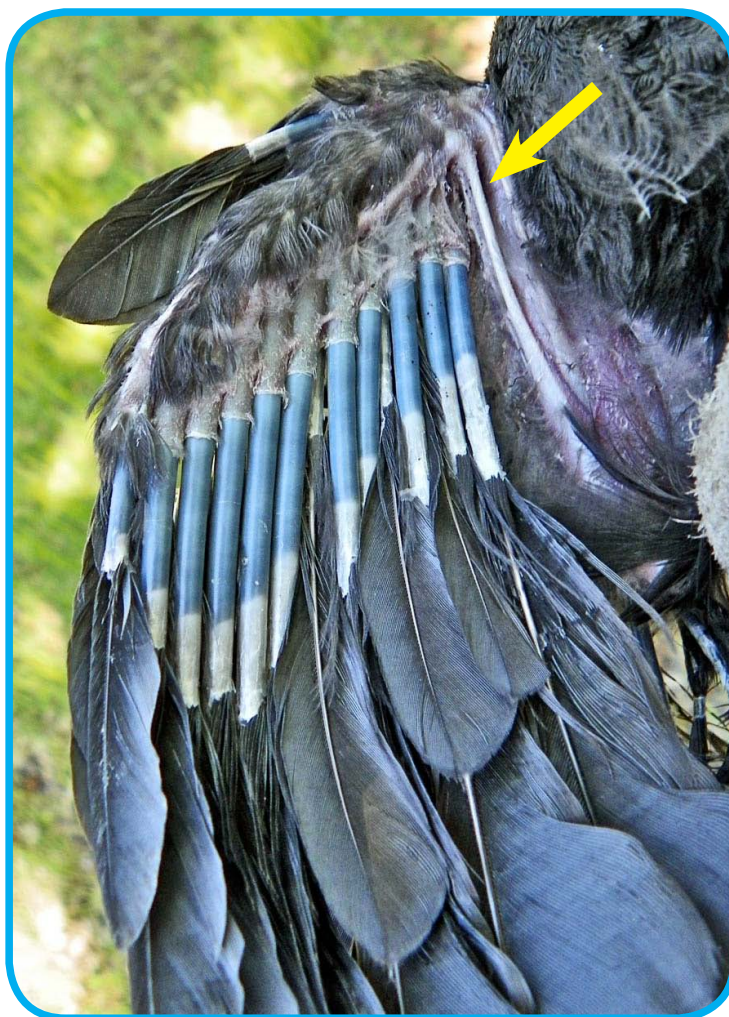
### Nestlings' activities

A 3-hour **Crow Cam (crow cam ustream by ISITE Design, Portland, Oregon)** showed 4 well-feathered nestlings, which probably will leave the exposed nest in 7–10 days (**Page 132**). The nest was built on a metal fire-escape on the 5th storey exit of a brick building. About 1/3 of the nest was inaccessible since it pressed against a brick wall and a round metal pipe. The wall side of the nest was white with crow shit, since the parents did not have room to remove fecal sacs with their bills. From the sounds of the adults at the start of the 3 hours, it was probably the nest of an American Crow.

The crow cam ran from 5:39 PM–8:39 PM on **10 June 2010**. Sunset on that date was at 8:59 PM, 20 minutes after the video finished, which explains why the young crows slept quite often and the last recorded nest visit / feeding was at 8:08 PM, 31 minutes before the video was finished and 51 minutes before sunset. With sunrise at 5:22 AM, the young had already been fed for about 12 hours.

The nestlings' early evening activities were – preening, one-wing stretches, two-wing stretches as a nestling stood tall and raised both wings above its body, pecking at feathers, toes and nest material, yawning, looking, snoozing in the cup or on the rim of the nest with their bills tucked into back feathers, begging to be fed, wing flapping, moving around the nest (none ventured beyond the nest), jumping across the nest from rim to rim, and defecating.

The parents that fed the above nestlings removed one or two of their fecal sacs per visit. The fecal sac was taken in the throat pouch, and disposed of away from the clean nest, or eaten. Only one crow at a time visited the nestlings. No helpers were apparent over



Underside of wing of Tarsus 3 days after it fledged prematurely. Feathers still require much growth before flight is possible. Some long wing bones are visible (arrow)





4 nestlings about 10 days before leaving the nest. One tripped and fell awkwardly with wings out



All 4 slept on the nest's rim with bills tucked



1 nestling practiced wing flapping, there was space for 2 young to flap their wings at once



1 crow stretched its left wing over a nestling resting in the cup



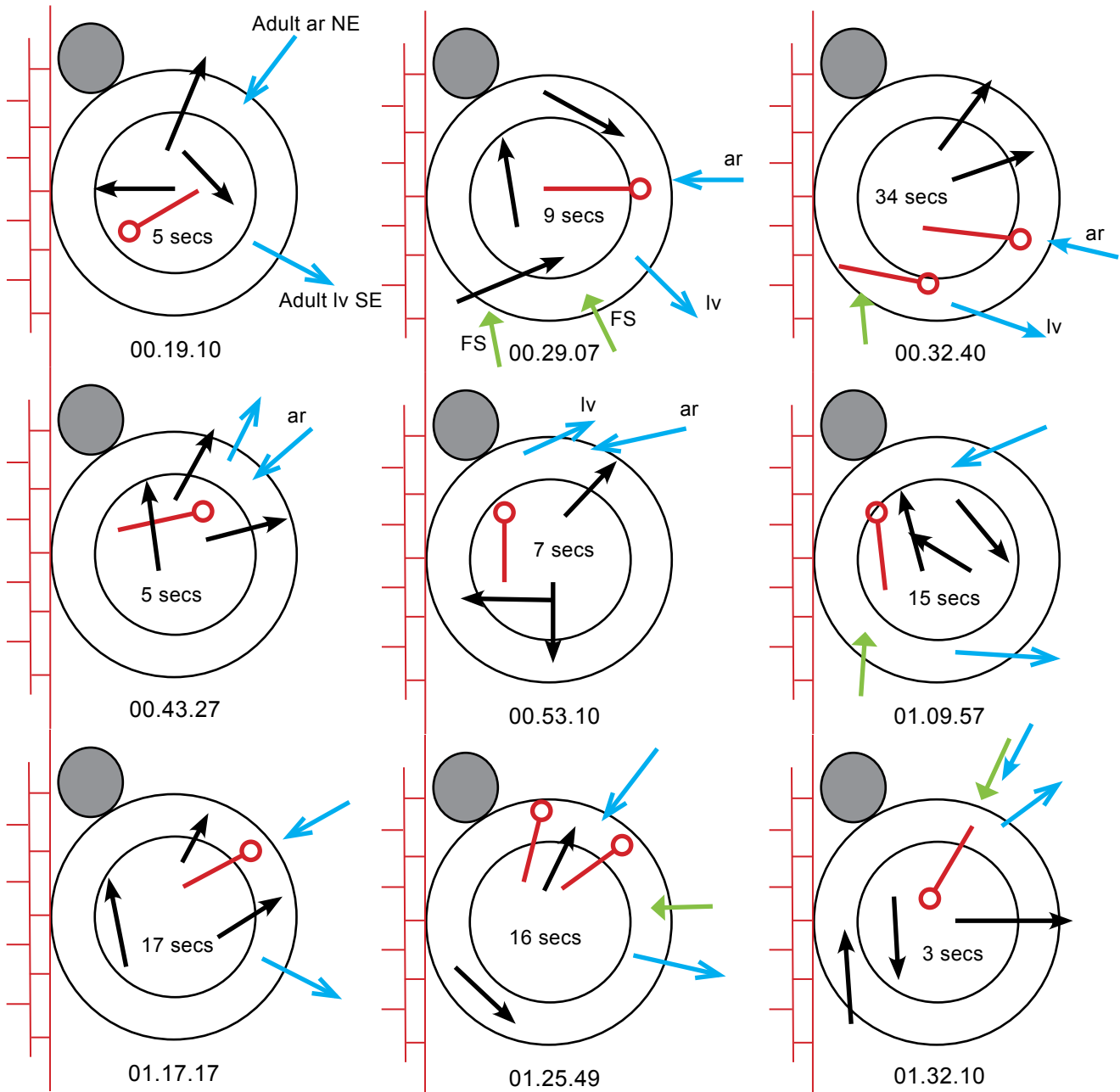
1 adult arrived and 3 of the 4 begged with open bills, the lower one also flapped its wings. A bulge from food in the adult's throat is visible



After being fed, a nestling often backed up to the rim and ejected its white fecal sac (uric acid + shit) which was taken by the adult (A) in its bill for disposal to keep the nest clean

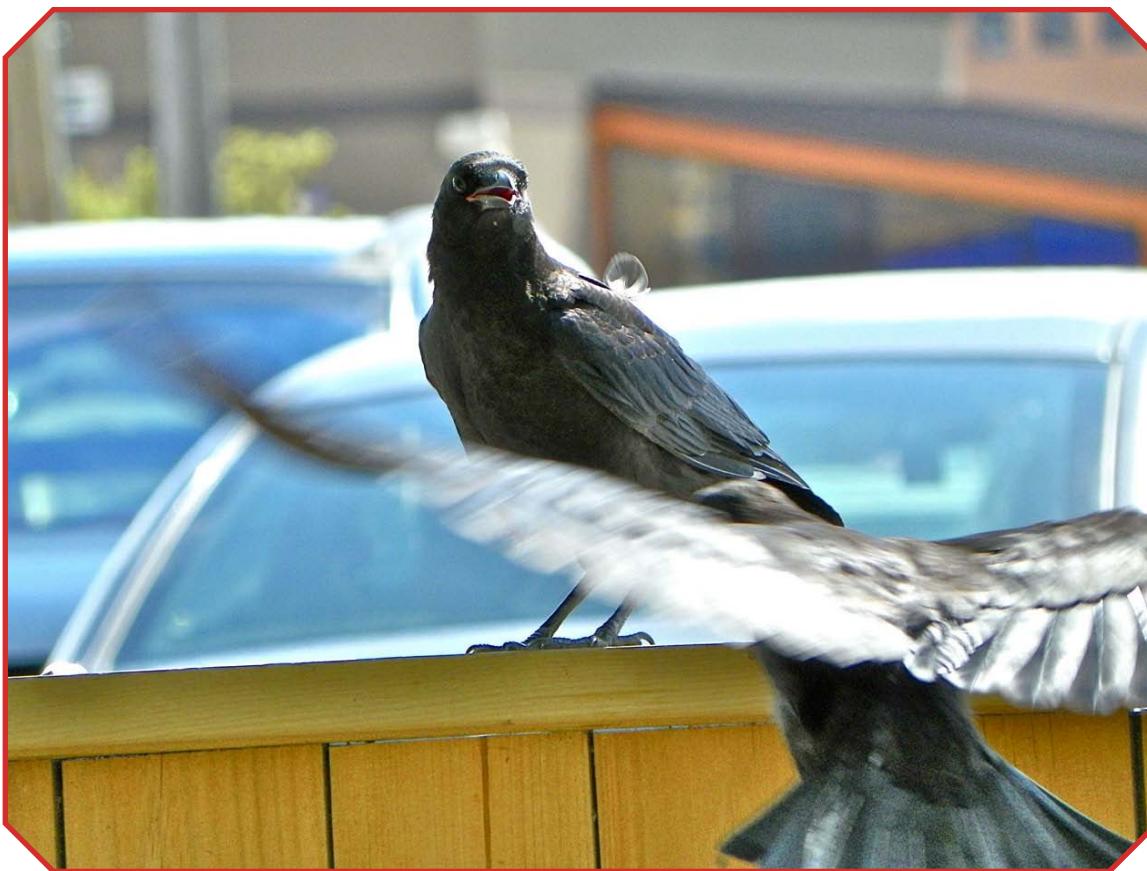
Photographs taken from an online crow cam, © by ISITE Design in **Portland**, which is a 3-hour video on 10 June 2010, starting at 5:39 pm





**133. American Crow** Nine timed nest visits by two adults with 4 large nestlings in a nest on a metal fire escape. The blue arrows → indicate the arrival (ar) and leaving (lv) of an adult. The red line —○ indicates the nestling that was fed. The green arrow → shows where a fecal sac (FS) was removed by an adult. The black arrow → shows the position of the other nest mates during a nest visit. Diagrams based on a crow cam, © by ISITE Design in Portland **Oregon** which is a 3 hour video on 10 June 2010, starting at 5:39 pm





Two juveniles, about 15 days out of the nest, explore new territory. By now they are walking on the ground

the three hours.

Nestlings have variable mouth color, at least near fledging time, but this did not correlate with the level of hunger or the body temperature of the bird. It was correlated with the age of each nestling and was a signal of the need to be fed by the different providers attending a nest <sup>r97</sup>. Perhaps the changing mouth color was another way for the parents to identify their young.

At no time over the 3 hour cam was there any aggression with bills or feet by any of the nestlings to one another. There was a lot of bumping as they moved around. During bouts of wing flapping by a nestling perched on the rim of the nest, its wing feathers whacked one or more nest mates on the head, with no harm. When 3 large nestlings were in the cup of the nest, sometimes they overlapped, with one or two covering the third nestling as they slept. The adults also showed no

aggression toward their young.

Earlier, I mentioned that nestlings developed a crouching (fear) reaction at about 18 days <sup>e40</sup>. Before this time, nestlings eagerly begged for food whenever a nest was shaken by crow watchers. After the crouching reaction set in, nestlings begged when a crow landed on the nest, but not from a human observer. The young were starting to look after themselves. In the crouched position the body was lowered and the neck and head tucked. Each grayish nestling became rigid and their eight toes tightly grasped the nest lining. This made them difficult to remove from their nest. Yet this hold-on-tight reaction was put to good use. When the feathered nestlings were lined up on a branch they sat quietly for a photographic portrait. In the final week prior to leaving their nest, the birds have the size and ability to flee from the nest <sup>e40</sup>. As a person climbing a





Crow picking gravel along a path in the Assiniboine forest in June

nest-tree approached from below, the nestlings might bail out of the nest with some eventually ending up perched on lower branches or falling to the ground. My presence at their nest, and when handling their young, drove the parents crazy – a fact not often mentioned in the clean journals.

**F**ood was rarely visible in the bill as adults approached their nest. The food was transported in their throat (antelingual) pouch. As she brooded her young, she watched him approaching, and when he was a few meters away, she lifted up to expose the young. She stood on one side of the nest's rim while he landed on the other side of the rim. He passed food into the waiting open red mouths. Or he fed her, or passed food to her, which she fed to one or two nestlings.

When food is visible in the bill of a parent, it provides a strong stimulus to the young *brachyrhynchos*. They call to be fed. This instinctive response was humorously displayed, somewhat by accident, when two well-feathered nestlings acted out this brief scene. Nestling **A** picked up a bit of food in the nest after a parent's visit. Immediately nestling **B** started begging to be fed. Inadvertently, a bit of the food was transferred to the outside of **B**'s bill, where it stuck. Seeing this food, **A** started begging from **B**. Neither young, I might add, was fed by the other.

In one situation where I was 10 m from a nest in a White Pine tree, low grunts were heard, I believe from the incoming crow. Groups of 10 and 12, or as few as two notes were produced at irregular intervals and generally at the start of feeding the fresh nestlings. No specific food call was given by the American Crow c52.

At a deciduous tree in Guelph, four older nestlings were visible. Their dark gray heads popped up when a parent with food landed on the nest's rim. Through a series of 47 nest-visits, in 11 cases one nestling received food, 24 times two

young were fed, and in 12 visits it appeared three nestlings were given food. It seemed neither parent carried enough food to feed all four nestlings in one nest-visit. If a young crow spit out its food into the nest cup, the adult retrieved the morsel and placed it into the open mouth of another nestling.

Among **Idaho's** Common Ravens, 1.4 and 1.6 nestlings were fed each visit at two nests with four and three young respectively 41s. Kilham watched 18 nest-visits, by the breeding male crow and helpers, to 3-day-old nestlings brooded by the breeding female. Six times (33%) the female was the only one fed; the female and nestlings were fed during 4 (22%) visits, and one nestling at 8 (44%) visits. The adults passed saliva (moisture) to their young with the food. When small young were fed, an adult crow sometimes placed all the food into one pink mouth, then removed some of it to feed the other nestlings k63.

Older nestlings of American Crows were fed one at a time. Nestlings were fed from the day they hatch up to about 4 months post fledging v18, which in Winnipeg would be into October. However, the parents usually stopped feeding the begging juveniles within 2 months. Juveniles continued to beg for food into August, but the parents often ignored their cries and eventually the young stopped begging. Kilham gave a shorter period of only 2 weeks before the parents ceased to feed juveniles after fledging k63.

Feeding occupied only a small portion of the nestlings' time in daylight. Observations (pre-cam) of a nestling's behavior are scarce. Luckily, I obtained two well-feathered nestlings on 22 May that someone dropped off at a local aviary. They were kept in a small outdoor wire cage. At my estimate of 20–22 days of age, they weighed 285 and 245 g and had wing chord lengths of 17 and 15 cm respectively.

After being hand-fed, they often settled down and slept. When perched for the night, the smaller





crow tucked its bill into back feathers. Sometimes a bird turned its head 90° and rested its bill on the side of its chest. A more relaxed posture developed in the evening as a nestling fell asleep on a branch. Both wings loosened and dropped away from the body. The tips of the primaries ended well below the body and perch level. Asleep in calm air, the toes were not wrapped tightly around the branch – it was more of a balancing act.



Two juveniles, 3 weeks since leaving the nest, continue to explore the territory of their parents in Winnipeg **Manitoba**

By timing the rise-and-fall of their back feathers for several bouts of 25 minutes, the breathing rate of the quietly resting or sleeping nestlings was 37 (27–43) breaths per minute. When perched together at night, the closest distance between them was about 5 cm in the summer. For three adult *Corvus* species, the Carrion Crow, Rook and Jackdaw in captivity, their respiration at resting ranged from 20–26 breaths per minute g73.

When active, nestlings pecked and pulled their own toes and those of their nest mates. The head, wings and tail feather tips of another crow were “played” with until the receiver of such actions became annoyed and quietly moved away. Bill wiping against an object developed slowly. One nestling in early June repeatedly wiped its bill in the hollow (nape) at the back of its nest mate’s neck. Preening was a common pastime for nestlings. Allopreening was not observed. About a week before fledging, one bird scratched its head with its toes brought forward over a lowered wing,

as the adults do.

When crows in **Illinois** nested in woodlots, parents nearly always gathered their food in nearby fields. Feeding on the ground in woods is not a common habit for American Crows. Furthermore, for crows nesting in a hedgerow or isolated tree, the feeding range was as far as 800 m from the nest 20b. Nesting crows in rural **Manitoba** had a mean flight distance of 350 and 430 m from the nest over two seasons. Flights longer than 700 m were seldom taken 84s.

The behavior of urban crows as they arrived at their nest-tree varied from a direct flight to a series of easy steps. For an example of the latter method, a crow in **Guelph** with food in its bill landed atop a conifer 60 m from its nest. It stayed there about four minutes. Then it flew to a closer conifer where it remained another three minutes. Next, a TV aerial 10 m from the nest held the crow for another 2 minutes. Finally, it flew to the nest site, fed the young in 15 seconds and departed.

On another warm May morning, a crow with a dry piece of bread flew past and out of my sight behind a home in **Guelph**. Several seconds later it reappeared on its way to the nest. Again this sequence was repeated; so I changed my position. The next crow solved the mystery. It landed on a birdbath, dunked the dry food into the water, then rose to the nest. Food and moisture were given to its nestlings at once – a perfect delivery.



American Crow on a wire





Each nest was built with a different array of branches surrounding it. This spacial arrangement, combined with the wind and location of feeding areas, partly decided how the parent birds came and went at the nest. Given the possibilities, each parent revealed its individuality. At one nest in a grove of ash trees, one parent landed seven meters north of its nest, remained still for half a minute, then flew directly to the north rim and fed its nestlings. The other parent landed three meters below the nest and hopped to it using several branches until it reached the southwest rim. Each adult kept to their routine for over an hour. The next day they had changed their approaches to the nest.

### Feeding trips to the nest

How often were feeding visits made to the nest or nestlings? Over the 3 hours recorded by the crow cam in Oregon, there were 18 visits to the nest, although two of the visits could be combined, since the adult appeared to perch on a metal railing out of camera view, while it waited for a nestling to defecate. At any rate, a nest visit averaged 14 (3–34) seconds in length. The average time between 17 evening visits was 8 minutes, 7 seconds. The shortest was 1 min 22 sec; the longest 22 min 17 seconds. Over the 3 hours, the 4 nestlings were fed at different rates – 6, 5, 4, and 2 times. The parents did not always feed the

closest nestling with an open mouth. Sometimes they reached across one nestling to feed another. Did this indicate the parents recognized their young and chose the one to feed? Recognition of the nestling may be due to several clues – size, personality, voice when begging, color, or individual traits that we, as egocentric, poorly trained observers, do not notice.

At six successful nests (some with helpers) in my study in **Guelph**, I tallied visits during 68 hours. A feeding visit to a nest averaged every 10 (1–54) minutes. For two nests in **Florida**, 1,952 nest-visits were recorded in 205 hours, or one every 6.3 minutes. As a qualifier, not all of these nest-visits involved feeding the young crows, and helpers helped with the feeding of the one and two nestlings at each nest <sup>k47</sup>.

In **Guelph** my timing of the length of 27 nest-feeding visits by one parent averaged 32 (10–85) seconds. Feeding the nestlings used 5–10 seconds. The remaining time during a visit was spent looking around, or doing some nest cleaning. Another nest in Guelph with three young, and at least one helper, had 13 visits averaging 50 (20–80) seconds.

Presented somewhat differently, Black noted one actual feeding every 35 minutes or 1.7 per hour at four nests in **Illinois**. The nestlings were less than 12 days old. Keep in mind his figures are for the frequency of each nestling being fed and not simply a nest-visit as I, and others re-



American Crows fit well into a busy urban moment. In **Winnipeg** they often nested in a cluster of planted Colorado Spruce. At the historical Forks where the Red and Assiniboine Rivers meet, the yellow arrow points to the location of a successful nest in spruce in 2009; late November 2011





3 June 2009, an American Crow with a bulging throat pouch prepares to land at its nest (arrow) in a solitary spruce in **Winnipeg**

females 45%. At 4 nests with helpers, males made 43%, females 14% and helpers 36% of the total feeding visits to the nest <sup>c11</sup>. During two years the feeding rates were higher at successful nests, but in 1988 feeding rates were highest at failed nests. Females without helpers made twice as many feeding trips to the nest as did those with helpers (1.4 vs 0.6 visits per hour), so helpers did lighten the feeding work of the females by making (36%) or 1.6 feeding trips per hour to a nest. However, “feeding rates at crow nests were not related to any measure of breeding success.” Female breeders spent more time at or near the nest, but this didn’t seem to lower the predation rate. As well, feeding rates did not influence the amount of time before nestlings fledged. Additionally, the feeding rate did not influence –

- (1) brood size at marking and fledging
- (2) total brood weight or mean nestling weight at marking
- (3) mean nestling length at marking

corded 20b.

At Ithaca **New York**, 10 urban and 8 rural crows’ nests were watched for feeding rates during 2 weeks prior to banding the nestlings at 28 days of age. The number of visits per nestling per hour was 1.5 for urban and 1.3 for rural nests. Time between feeding visits at urban nests was 4.1 min, and 2.6 minutes in the country <sup>h66</sup>.

In **California**, Caffrey studied colonies of nesting American Crows on two golf courses from 1985–1990. A subset of 173 crows were measured and marked with patagial wing tags and leg bands. Caffrey recorded average feeding rates over the entire nestling period at 4.6 times per hour at 9 nests with helpers, and 3.8 times an hour at 10 nests without helpers. Furthermore, at 3 nests without helpers, she found male breeders contributed 55% of the total feeding trips and

During the first several days after hatching, the male was the main provider, making about 67% of the feeding visits since she was brooding the young. After the eighth day, she made up to 68% of the feeding visits to nestlings <sup>4b0</sup>. Food for 776 nestlings of all ages was mainly insects and spiders (58%) whereas rodents, other mammals, carrion and corn amounted to 25% <sup>k12</sup>

In **British Columbia**, each Northwestern Crow nestling was fed by its parents 2–3.4 times per hour. The highest rates coincided with the first two weeks of the nestlings’ lives <sup>4b0</sup>.

An American Robin starting singing 105 minutes before sunrise one May morning. Later that same day, in **Guelph**, the first two feeding visits at a crow’s nest took place 24 and 14 minutes before sunrise. From occasional observations at





**29 May 2011 American Crows** Three nestling on a branch of a Colorado Spruce tree that held their nest (N) and now them. Within a few days they flew to a nearby Cottonwood (background) where they were cared for by their parents until they were able to join them on the ground and slowly learn to feed themselves





other nests, I would estimate feeding visits to the nest were made 1–3 times before sunup. Lingering about in the evening on nest-watching duty, the last five feeding visits at one nest averaged 37 minutes prior to sunset. At another nest the final five evening visits averaged 25 (40–13) minutes before sundown. As a parent landed on a nest 10 minutes after sunset on a clear evening, the dark nestlings reached skyward with open bills. Within a couple of seconds they realized this was not mealtime and quickly slipped out of site below the rim of the nest.

### Nest cleaning

Along with feeding, nest cleaning is an important job that parents perform for their offspring. I would estimate nest cleaning takes 30 minutes a day. And like feeding, it began before sunrise and ended a few minutes before sunset. Crow nestlings eat and young ones shit in their nest. When older and taller, they back up to the rim, shake their little tails and excrete (squirt) over the side. Twice have I observed this latter performance. Others have remarked on the infrequency of this habit. But a look at the crow cam from Portland showed it was a very common behavior for older nestlings right after they were fed.

From ground level and at a distance, the cleaning posture was distinctive. The adult crow's head was below the nest's rim, out of sight. The bill was poked into the cup lining to remove fecal material and possibly parasites (larvae) as suggested by some crow-watchers. The tail and primaries were visible, the latter pointing to the clouds. Frequently, the feathers shimmy vigorously over short periods of time in response to digging by the bill. The outside rim of the nest was also inspected and "swept." Whenever I climbed to a nest with young present, or after all had fledged, there was no odor or sign of excrement. American Crows are clean birds.

### Fecal sacs

There are two theories about parental decisions – should they eat the fecal sac, or carry it away.

(1) if they eat the sac they gain some nutritional value and they can remain at the nest near the nestlings.



In a Siberian Elm with green clumps of ripening fruit, an adult crow cleans the bottom of the nest with its bill to keep it healthy and livable for its nestlings. The body and tail shimmy as the bill works in the bottom of the cup – **Winnipeg**

(2) if they fly off with the sac and drop it, they lose time and energy, and they are away from the nest and nestlings <sup>70h</sup>

From 1989–1991 McGowan watched nestlings for 84 hours in and around Ithaca **New York**. Adult breeders ate 24 sacs and flew away with 23. Alone at a nest when a white fecal sac was ejected, it was removed by the adult, regardless of the age of the nestling. Fecal sacs ingested by adults declined as the nestlings got older. From 15 sacs produced with both parents at the nest, the female breeder ate 10 (67%) of them. During 25 events when sacs were produced, the crow received the sac and left the nest at once. The sac was only eaten 4 (16%) of the time. It was believed nutrition was the reason why most of the sacs were eaten by the female breeder. Why do parents lessen their consumption of the sacs as nestlings mature? And what information did parents obtain about a nestling's health by the ingestion of its fecal sacs? <sup>m81</sup> Caffrey noticed some fecal sacs being eaten even as the nestlings were





about to fledge <sup>v18</sup>. Others identified helpers assisting with nest sanitation, although neither knew to what extent <sup>k47, g34</sup>. Kilham watched crows carry fecal sacs in their bills and drop them on the ground or on a branch 20–50 m from their nest <sup>k63</sup>. The crow-cam in **Portland** showed all fecal sacs of older nestlings being taken by their parents.

### Breeding success

**M**any of the statistics below were gathered from nesting studies where the field workers climbed to the nests one or more times. This disturbance factor is rarely mentioned or indicated by the number of visits to each nest and at what stage the nest was at when first visited, which may be used for comparisons of studies. Ideally, researchers should set up a control study in the same area where nests are not peered into, but followed from the ground to determine the percentage of nests that fledge young crows. Then compare this result to the one where the nests were climbed to, in order to establish an index of disturbance by researchers.

From a life-table, American Crows' eggs in **Illinois** had a hatching rate of 71% <sup>20b</sup>. Emlen reported 88% of 77 eggs in **California** hatched <sup>e40</sup>. In the parklands of **Saskatchewan**, crows had an 87% (85–90) hatching rate for 373 eggs in 78 nests. The number of eggs lost to predators (5%) and unhatched (8%) totalled 13%. And there's more – from 325 eggs which hatched, 65% of the nestlings were lost, leaving 35% to fledge. For 45 of 78 nests, 58% (45–72) fledged one or more crows <sup>i04</sup>.

The mean fledgling success of American Crows in Ithaca **New York** and the surrounding farmland was <sup>m85</sup> –

#### SUBURBAN CROWS

Fledglings per nest 1.6 (n 287)  
Fledglings per successful nest 3.1 (n 151)

#### RURAL CROWS

Fledglings per nest 1.6 (n 72)  
Fledglings per successful nest 3.6 (n 33)

The nesting of marked Carrion Crows was enjoyed for 3 years in **Switzerland**. Success and nestling growth rates of urban and rural breeding crows were compared <sup>r64</sup> –

- (1) nestlings in an urban environment grew more slowly than nestlings in the country. Urban nestlings gained weight more slowly and were lighter at fledging time
- (2) urban nestlings' tarsal growth was slower and the tarsi were shorter when they fledged.
- (3) successful breeders in urban habitat fledged an average of 1.5 young compared to 2.7 young in the country
- (4) after measuring tarsal lengths of breeding crows, it was determined that only 21% of urban fledglings were large enough to establish a territory compared to 76% of rural fledglings

From several studies in the **United States**, a fewer number of fledglings (mean 1.1) were generated per urban breeding pair of American Crows than crows nesting in suburban, wild or



Take off from the ice on a pond. Crows and ducks nested near this water





rural sites (means 1.5–1.9). This reduced number of fledglings associated with urban nests was due mainly to a higher loss of nests rather than fewer fledglings per successful nest m50.

Interactions of American Crows with their environment and other songbirds were examined around Puget Sound **Washington**. The crows maintained an average home range of about 18 hectares. The highest use by crows was at a mix of pavement, grass and trees, compared to forests. Each crow used the various types of land cover evenly over its home range compared to all the crows at a site. Birds selected habitats at different scales.

In various parts of the landscape, the rates of successful nesting were not correlated with predator abundance. Breeding success occurred for 52% of the disturbed nests and 49% of breeding territories (all species and years combined). As expected, songbird richness was the highest in less developed areas where forest patches were prevalent 20w.

In western **Poland** the Hooded Crow was studied by P Zduniak for 6 years in a riparian valley subject to flooding z09 –

Average # of fledglings per nest 1.5

Average # of fledglings per successful nest 3

In **Massachusetts** at Cape Cod, American Crows had an annual mean number of fledglings of 2 (0.8 in 1983 to 3.3 in 1986) per nest (n 46); (5–14 nests per year produced fledglings) c56. In **Illinois** crows had an average of 2.4 young fledge from 132 nests with incomplete histories 20b. Black gave these statistics for successful nests in Illinois (1 or more young fledged) 20b –

**7 nests**, 31 eggs, 97% hatched  
87% young reached banding age (18–20 days)

In a subset of successful and unsuccessful nests combined –

**11 nests**, 49 eggs, 67% hatched,  
55% of young reached banding age

For **British Columbia**, 13 of 16 (81%) nests of American Crows produced fledglings c31.

For Northwestern Crows –

746 eggs; hatching rate 74%; non-hatching rate 18%; predators made 8% disappear

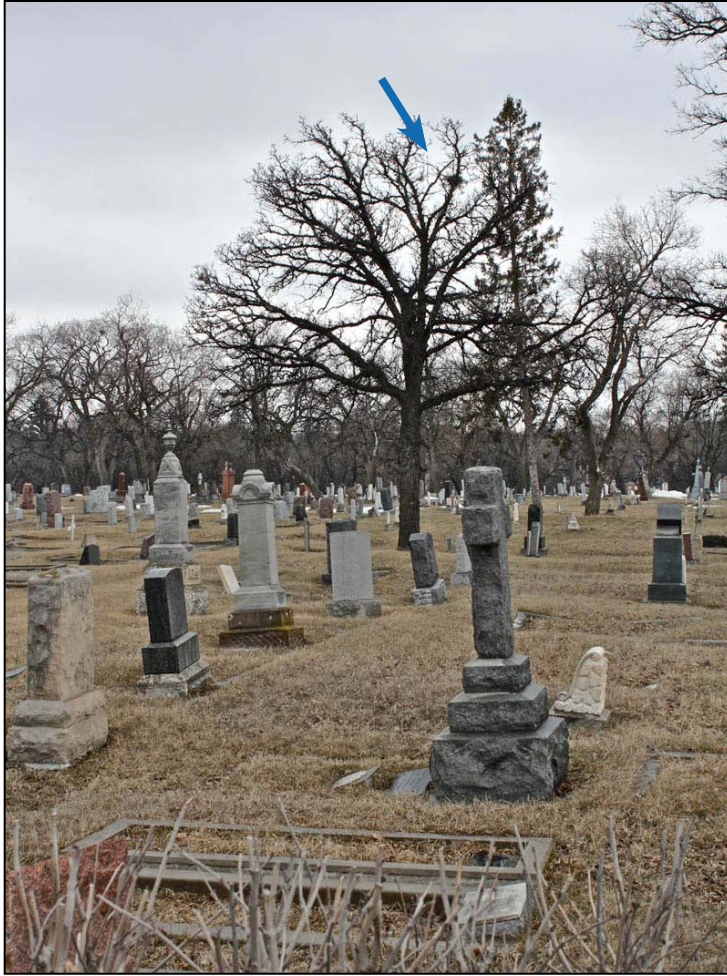
However, the fine print below Table 3 in the results of the original paper revealed the above percentages were based “Only on nests with full clutches (3 or more eggs) in which at least one egg hatched.” A slight bias towards the pleasant side of life was introduced by this selective process of the investigators. They peered into 187 nests of NW Crows 4b0.

In Encino **California**, from a 6-year study of a smaller race of the American Crow c13 –



A young crow moves away from its nest, but may stay in the nest-tree for a day of two before its first flight to another tree





Urban cemeteries with hectares of mowed lawn and mature trees provide a sustainable habitat and quiet haven for nesting and feeding American Crows. Arrow points to a new nest in a Bur Oak in **Winnipeg** on 24 April 2013

**78 nests** – 44% of nestlings died in their first 7 days of life  
98% of these were the youngest or the lightest nestlings

K McGowan thought Raccoons, *Procyon lotor*, were the main predators of crows in **New York** state. In predated nests he found Raccoon shit, other signs, and sometimes a Raccoon asleep in a nest. [I have also seen a Raccoon resting in a crow's nest.] Great Horned Owls, *Bubo virginianus*, also left decapitated nestlings and owl feathers in a crow's nest. He thought female breeding crows killed on their nest were the night work of these owls. Bands from fledglings were recovered from owl pellets. Inexperienced fledglings / juveniles died from other causes – cats carrying fledglings in their mouths; Red-tailed Hawks carrying young; crow remains below nests of Cooper's Hawks; hit by cars; trapped in vegetation; electrocution on overhead lines; killed by people. In Guelph **Ontario** I studied nesting crows for 5 years. Then, a few years later, I found two juveniles dead below power poles in the city during one week in July. These were the first and only instances of death by electrocution I noticed. The tan toe pads of the juvenile crows were badly burned and blackish.

147 nests, 43% fledged at least 1 young  
24 renests, none successful

With the smaller race of crows in **California**, of 77 “undisturbed” eggs in 22 nests, 88% hatched. The eggs shells disappeared from nests within a few hours after the young hatched – probably removed by the parents e40.

From Elstow **Saskatchewan** i04 –

**20 nests** – 96 eggs; 85% hatched  
4% of eggs predated, 10% did not hatch  
65% of nestlings predated or starved  
35% fledged; average 1.5 fledglings per nest

In western **Poland**, the number of fledged Hooded Crows was set during the first 12 days of the 32 day nestling period, as thermo-regulation was developing. Days 4 and 5 were the most critical. Starvation was the most common cause of death. And water levels of the nearby rivers seemed to be associated indirectly with this survival. Fish remains in this habitat were the chosen food brought to the nestlings. As well as other invertebrates, eggs of waterbirds such as coots, gulls and mallards were also delivered. The higher the water level in the rivers, the greater the food supply available over the nesting season z09.

In Encino **California**, 3 reasons –





- (1) predation (82%) from 52 of 63 failures
- (2) 22 of the 52 (42%) by direct evidence
- (3) sudden abandonment 30 of 52 (58%)

were the main causes of nest failure in the colony of American Crows. Red-shouldered and Cooper's Hawks preyed on nestlings. In 1988, a pair of Great Horned Owls nested on the edge of the study area and subsequently became the main predator of crows of all ages. For the remaining 11 of 63 nest failures –

- (1) eggs of 1 nest didn't hatch (incubated 4 weeks)
- (2) wind blew down 5 nests
- (3) feeding rates were reduced at 5 nests prior to abandonment

From successful nests (n 59) an average of 1.9 young fledged. Of the marked fledglings (n 68), 79% or 1.7 fledglings made it successfully to the ground (about 2 weeks after leaving the nest). Of the fledglings making it to the ground, 89% of them lasted another 2 months. Except for one year, the successful pairs of breeders began incubation about 4 days earlier than nests that failed, and the breeders with helpers also began incubation about 4 days earlier than breeders without personal assistants. The success of a crow's nest was not related to its distance from the nearest crow nest or to the success rate of neighboring nests c13.

Fledglings / juveniles in the same Encino **California** population had a 71% survival rate for their first two months after leaving the nest, and 68% of the juveniles survived their first year (6 months) to become yearlings. Fledglings and yearlings died in several ways – falling from the nest tree to the ground before they could fly; eaten by owls and hawks; lung tumors (dissection); and hit by golf balls. Starvation did not appear relevant.

The rate of egg-capping (a piece of egg shell slips over the end of an unhatched egg) was observed for the Northwestern Crow on two islands

off the coast of **British Columbia**. At 263 nests with 765 eggs, only 1 egg in 3 different nests was capped (1% of nests). Only 3% of 106 unhatched crow eggs were capped. Usually crows carried the eggshells away shortly after a nestling hatched v14.

In the suburbs of Tokyo **Japan**, two groups of nesting Azure-winged Magpies, *Cyanopica cyana*, were compared. The ones that nested near the nests of Japanese Lesser Sparrow Hawks, *Accipiter gularis*, had less protective cover, but were more successful due to the defending behavior of the hawks against other predators u01.

In Winnipeg **Manitoba**, two pairs of breeding American Crows nested successfully several years in a row. Each pair nested well within the territory of a nesting Peregrine Falcon. I never saw the falcons and crows interact. Part of the reason is this swift predator does occasionally feed on aerial insects. Great photographs showed falcons taking the California Stonefly, *Pteronarcys californica* in the air over Missoula County **Montana**. The capture rates in June ranged from 1–8 stoneflies per minute 90s.

Over Caffrey's 6-year study in **California**, additional information included –

71% (25 of 35) nests with helpers fledged young  
34% (37 of 108) of nests without helpers fledged young crows



**American Crow** Many juveniles die in their first year





Perched in a cottonwood tree, a fledgling on day 1 after leaving the coniferous nest-tree preens its right wing. The long ulna and radius bones of the right wing are visible (arrow)

However, when using statistics to compare breeding pairs that had helpers some years, but not all years (the sample was less than 10 in all cases), the trend was some pairs were consistently successful breeders with or without helpers, and some breeders with helpers were not significantly more successful than when they didn't have helpers. The helper effect may not be as great as shown since they may be helping the most successful breeders that would be successful without them. It may be that helping the successful breeders could be a learning and survival experience for a yearling. Even so, the first breeding attempts of young crows (n 26) were unsuccessful regardless of helping experience, sex or age. Continuing, Caffrey told us successful nests (n 15) with helpers gave 2.1 fledglings and the same successful breeders (n 16) without helpers produced 1.9 fledglings. For these particular crows,

a successful breeding season leads to the presence of helpers the next year, rather than helpers leading to a successful breeding season. But if the helpers were “useless” yearlings, (75% of the helper population) this may be the reason they have no effect on nest success. Five older birds that stayed with their parents for 2 or 3 years did not help every season. After reworking the statistical data, her original find of helpers not making a significant difference to breeding success seemed to hold. She told us the number of helpers in the family group did not affect nest defence. Nesting in a colony meant that all the crows and helpers attacked an invading hawk in the daytime. In conclusion, why does the helping syndrome continue prior to dispersal?

The survival of fledglings / juveniles over their first 2 months did not seem to be altered by breeding pairs of crows with or without helpers. The heaviest nestlings seemed to have a better chance of survival to fledging and as juveniles (HY birds). Bigger was apparently better, even for nestlings.

## Body weights for nestlings 32–38 days old

### Pre-fledgling

Survived 320 g; Died 275 grams

### Post-fledging to one year of age

Survived 335 g; Died 289 grams

## Tarsus lengths for nestlings 32–38 days old

### Pre-fledgling

Survived 5.5 cm; Died 5.3 cm

### Post-fledging to one year of age

Survived 5.6 cm; Died 5.3 cm c13

Pairs of crows that started nesting early had higher feeding rates to their nestlings than did pairs of crows that bred later in the season c08. A pair of crows in **Winnipeg** nested successfully in a Colorado Spruce in the same nest several years





in a row. The years when I enjoyed their nesting cycle, they produced the first fledglings of the season on the last days of May or first two days of June. And I never saw a third crow with them at the start of the nesting season.

When crows feed in small or large groups, sentinel crows are common. Wilson studied this aspect of the breeding cycle in Ithaca **New York**, on a marked population of cooperative breeders. Being a sentinel was an obvious task during the nesting period. In cities, it was a sure sign of an active nest nearby when a sentinel was present each day at the edge of a rooftop, atop a street light pole, or a tall tree near the nest. When a breeding pair, without a helper, occupied a territory, the male sentinel guarding his mate and nest must forgo feeding while on the job. Sentinels were more obvious when the nestlings were larger and more worthy of protection. The presence of helpers also increased the amount of time sentinels were on duty and the number of sentinels available for guarding the nest. Two-year-old helpers were better at being sentinels and help-



Feathers on the back are scale-like in appearance

ing to feed the nestlings. Even crows improve with age. Other than being a target of predation itself, a sentinel was stationary on its perch and used very little energy 08w.

■ injuries to male American Crows reduced their contribution to the pairs breeding potential. From 27 family groups of marked and 96 sampled broods from 2004–'09 at Ithaca **New York**, injuries and permanent disfigurement of the wings or feet occurred to 26% of the breeding males. The injured males had fewer nestlings per brood, more extrapair young per brood (the result of matings of the female with males other than her paired male partner) and more adult auxiliaries in their groups than uninjured male breeders. These differences explain some of the variation in outcome at nests of breeding crows t66.

Nesting success in the 1920s through the 1940s was altered by man the modifier. Across the Canadian Prairies, and into the Great Plains to the south, hundreds of thousands of eggs, adults and nestlings of American Crows were destroyed to make us feel proud about our *false* contribution to the conservation of waterfowl in North America. Today, the crows and ducks remain together. Hunting of wild animals has dwindled considerably in the last few decades, and we now enjoy our eggs over easy at neighborhood cafes. There, the conversation does not concern crows and waterfowl. A lively discussion of crows as tool creators and users may arise, however.

Around Newburgh, Aberdeenshire, in north-eastern **Scotland**, there was synchronization among nesting Carrion Crows y13. The mean distance between trees with a nest was about 500 m, with the minimum distance about 150 m. Egg laying fell between 20 April and 10 May. The closer together the nests, the more synchronous the breeding. This resulted in lower cannibalism on eggs and nestlings from neighboring Carrion Crows. There appeared to be an increased survival advantage from synchronous breeding. The assumption was that if all the pairs were busy nesting and feeding, they wouldn't have time to interact negatively with each other's nests d08. However, it was not mentioned if there were roving flocks of non-nesting crows in the study area,





which consumed nest contents regardless of, or because of their synchronicity in breeding y<sup>13</sup>.

There have been no published papers on hybridization between the American Crow and the two coastal crows – the Fish (east) and the Northwestern (west). However, in northern **Italy**, researchers in the 1980s explored the narrow range of overlap of two Europeans – the Carrion and Hooded Crows, which have different plumage coloration. Nesting was compared in two areas – where the two species' ranges didn't overlap, and where they did overlap –

(1) In areas where the parental phenotypes coexisted, there was positive assortative (similar characteristics) mating

(2) The reproductive success of hybrid phenotypes (pairs containing hybrid individuals) was not inferior compared to that of the pure parental pairs. However, some hybrid females had peculiar maladies in their breeding

(3) The breeding parameters in the two parts of the hybrid zone seemed similar, while outside of the hybrid zone there was an asymmetry of breeding success s<sup>06</sup>.

One might think the size of the nest and abundance of American Crows would make a nesting study quite easy. So thought Ernest Good, who pursued crows from 1949–1951 for his PhD. He soon encountered unexpected problems. Although over 100 nests came within his reach on 1,036 ha of central **Ohio** farmland, he was left frustrated. Unmarked birds and high nest predation (probably the after-effect from his climbing to each nest) limited his results to where he was not able to offer a percentage on nesting success. He was left wondering how crows could be so abundant when so many of the nests [he

disturbed] ended in failure? g<sup>34</sup>

After a small percentage of eggs failed to hatch near Saskatoon in **Saskatchewan**, the nestlings experienced further losses. Those that died generally did so when they were quite young. In nests, 44% of crow chicks died within 7 days of hatching, and of those chicks which disappeared [from predation] the majority (59 of 60) were the youngest or lightest in each brood. i<sup>04</sup>

In **British Columbia**, 57% of Northwestern Crows' nestlings were lost over the first week; whereas, after nestlings reached 21 days of age, none disappeared 4b<sup>0</sup>. Young altricial crows are helpless in their first week of existence, and if food, shelter, warmth and protection are not provided, they do not die hard.

Nesting success, that is, a nest from which one or more young crows fledged, is the bottom line for population continuance. The percentage of nests that fledged birds, and the number of young fledged per nest are indicators of population growth, decline, or stability. There may be a difference between nest success and annual reproductive success. Where it occurs, we must mention the breeding strategy of the species under study t<sup>34</sup>. Does the crow renest (yes), or have more than one brood per season (no)?

During the 1980s, I studied nesting on four sites for 3 years in Guelph **Ontario** (Map 81). The sites averaged 145 (121–181) hectares. My study revealed 30 of 38 nests (79%) were successful (fledged at least one young). False nests were not included. The inclu-

sion of nests located near, but outside the boundary of the four sites, raised the total to 76 nests and lowered the success rate to 76%. Over 90% of the nests were in tall conifers. Consequently, my urban crows did not have to endure distur-





An Eastern Kingbird, *Tyrannus tyrannus*, about 22 cm long (half the length of a crow) physically harasses American Crows that enter its nesting territory

bances by me – their successes and failures were their own. In 1987, a follow-up small survey of 11 crows' nests resulted in a 91% nesting success rate. In this study in Guelph, I did not count the number of fledglings per nest. The main reason was fledglings can sometimes move a block or two from the nest within a few days after fledging. And they can be difficult to find among the leafy trees. They can fly from tree to tree, but it takes a while before they can achieve lift off from the ground. What I can add – 5 was the highest number of crows fledged from a nest in **Guelph**. From the literature, this appears to be the highest number fledged anywhere for the American Crow.

In 2008 and 2009, I did a nesting survey of unmarked crows in Winnipeg **Manitoba**. As usual, nests were observed with field glasses from the ground. Of 47 nests, 74% were successful. Nests in deciduous trees had a success rate of 64%, and those in coniferous trees 84%. The nestlings fledged in late May (3%) June (87%), and July (10%). My guess is at least some of the July fledglings were from renesting attempts <sup>r28</sup>.

The lowest nesting success was reported by Emlen for a colony of 60 pairs in **California**. This was because his 1-year nesting study was a side-event to the actual business of collecting eggs for experimental purposes. His constant egg robbing or adding, and general disturbances through 10 visits per nest, caused some unusual behavior by

the crows. In response, the crows renested and built 111 nests in all – almost two nests per pair. Another outcome was 88 nestlings hatched in 31 nests (2.8 per nest) but only 20 in 13 nests survived to day 30, giving an atypical nestling mortality of 77%. In spite of numerous visits to nests for his research, he wrote “Activities of the observer were probably a minor factor in this heavy mortality.” Yet he mentions no other predators or disturbances in the spring of 1942 to the nesting American Crows. The greatest losses were due to desertion of nests (the ones he repeatedly disturbed?) by the breeding crows and competition among nestlings in crowded nests (presumably the nests in which he added eggs?) <sup>e40</sup>.

In comparison, Black offered a 55% conversion rate from eggs to nestlings reaching banding age in **Illinois**. He calculated 2.4 American Crows fledged per nest <sup>20b</sup>. The Northwestern Crow, achieved a 79% nesting success, which translated into an average of 1.4 nestlings leaving each nest <sup>4b0</sup>. For this Pacific species, 37–57% of the hatched crows flew from their nests <sup>r58</sup>.

Eight separate studies of American Crows, in a variety of habitats and locations, from city scapes to wildlands, between 1982–2000 in the **United States** were summarized <sup>m50</sup> –

Number of breeding attempts 19–202  
Percent success 43–78  
Mean # fledgling / breeding pair 0.8–2.1  
Mean # fledglings / successful nest 1.9–3.6

Prior to the arrival of West Nile virus in North American in 1999, the outlook from a model of annual population growth based on adult breeding crow survivorship was positive in all four categories of habitat –

urban 6%  
suburban 16%  
rural 7%  
wildland 4% <sup>m50</sup>

The question of clutch size is important in relation to breeding success. Why, for instance,





do crows lay clutch sizes of four or five eggs most often? A partial and perhaps practical answer exists for the Northwestern Crow. Clutches of five eggs did not result in more fledglings than did clutches of four eggs. It was suggested this was due to a limited food supply and decreased hatching success. For example, the percentages of eggs hatched from clutches of 3, 4 and 5 eggs were 71, 79 and 67% respectively. So a clutch of four eggs was presently the norm around which environmental and genetic factors determine this crow's reproductive output. And the nest cup is built to hold four large nestlings comfortably<sup>r58</sup>. Five nestlings are crowded. With Rooks "brood size is probably so regulated as to maximize the reproductive potential over the entire life time"<sup>21r</sup>.

European studies of corvids revealed no alarming outcomes. A 60% nesting success for the Carrion / Hooded Crow was achieved in the countryside of **Scotland**<sup>c61</sup>. Nest robbing by the crows themselves, and human disturbance were the two most limiting activities to a perfect season. For the Hooded Crows in Troms County **Norway**, the thin line of truth was examined behind the corvid / ptarmigan / grouse relationships on a 2 by 5 km island. A digest of the 4-year exercise showed 88% of the 26 crow nests had a gainful outcome. And 19% of these nests fledged five crows, the highest number per nest<sup>p06</sup>.

An intriguing side of nesting behavior is that American Crows occasionally eat the eggs and young from other birds' nests, but not from their



**Canada Anemone** began to bloom on 6 June as American Crows started to fledge in **Winnipeg**

own nests, or the nests of other American Crows. Something controls this selective, self-preserving behavior. The Carrion Crow in Europe is a close relative of the American Crow. As its name suggests, it is more of a carnivore and regularly preys on the contents of nests of other Carrion Crows. Yom-tov examined the Carrion Crow's role in recognizing its own eggs and young. Location and timing were important. He showed egg recognition was poorly developed, but what did develop was a powerful control against eating eggs and nestlings in their own nests. Recognition of their own chicks took about three weeks, after which the parents consumed chicks of the Herring Gull placed next to their young in a nest. The general outcome was most of the eggs and young birds placed in nests of Carrion Crows were not eaten by the breeding pairs<sup>y14</sup>.

If eggs were not eaten, they may be moved. A peculiar episode of egg moving at a Black-billed Magpie's nest involved the disappearance of four eggs during incubation, only to have the return of two eggs<sup>t75</sup>.

An unusual occurrence took place in central **Iowa** where 59 nests were being shadowed. A young crow was added to another crow's nest. At the nest in question, on 1 May it held 3 eggs; on 8 May there were three young about five days old, but one died when the researchers took a sample of its blood. It was removed from the nest. On 30 May, when the researchers returned to band the nestlings, three about the same age were present. They suspected the extra crow was added, probably as a fresh nestling. The closest nest was 500



Fledgling resting on the branch of a spruce. Note the pinkish line where the bills meet near the eye





meters away. This was the first such report of an avian transfer s34.

In the northeastern corner of **Alberta**, the delta area was explored around Lake Claire at the western end of Lake Athabasca. Two people were sent by the Milwaukee Public Museum to film the bird life in June 1928. An unusual nest of the American Crow was discovered. On 15 June it contained 3 eggs and one nestling about 1 week



old. By the next morning's visit a fourth egg had been added. They noticed 3 crows in the area and assumed it was a community nest. In 1930, birders were unaware of helpers. The threesome they saw was probably a family of crows. This however, did not explain why eggs were being laid with a nestling several days old in the nest. From their time in the field, the explorers reported a huge number of waterfowl nesting in the area, but they saw no interactions between the crows and waterfowl j61.

In western **Poland**, Hooded Crows nested in a riparian valley. The mean hatching success of their eggs was 75% (69–81%). From 221 visited nests, 559 nestlings hatched for an average of 2.5 (2.3–2.8) per nest. At nests where at least one egg hatched, the average was 3.4 (3.2–3.6) nestlings per nest. At 105 controlled nests, 50% fledged young. The highest number of eggs lost (5%) was due to faulty nest construction or location, followed by 5% from predation. Unknown causes of nest failures with eggs was (12%), and for nestlings (14%) z08.

Relationships are everywhere. One exists between the age of the breeding pair and their success at nesting. None of my crows in **Guelph** or **Winnipeg** were banded, aged, or sexed, leaving me unable to establish this relationship. For now, the answer can only be hinted from the work of others. Setting up video cameras and a hide in a rookery (a colony of nesting Rooks in Europe), it was decided adult Rooks nesting for the first time expended more parental energy for each offspring raised than did older breeding pairs. Genuine inexperience and inefficiency of younger crows were the reasons. Furthermore, young females produced smaller clutches and did not hatch as many of their eggs as did the older females in the population of Rooks 19r.

There have been no reports of American Crows producing a second brood in one nesting season after the first brood fledged. One report exists for the Common Raven. A pair on the campus of the University in **California** at Riverside had two broods in one season. The pair built a nest on a 3rd-floor window awning. The first brood of 2 fledged about 3 May. The second brood of 3 fledged on 4 July. Both batches of juvenile ravens remained on their natal territory





A wing / leg stretch is a comfort exercise

for less than a week, which may have cleared the way for the second brood w42.

**N**ow that young American Crows have left their nests, I reviewed the short story for the **Guelph** population. In general, an entire nesting season (with no renests) occupied 13–14 weeks (91–98 days) and unfolded slowly like this –

- 10 March** nest-building began
- 24 March** first egg laid
- 26 March** incubation began
- 13 April** first egg hatched
- 16 May** first nestlings fledged
- 16 June** last nestling fledged

For an individual nest, from the start of nest building to when the young fledge was about 8 weeks (53–59 days) 20b.

In **Winnipeg** the first young may leave the nest during the last few days in May. Unmarked crows that probably renested after the first nest failed, had young fledge about mid-July. During a mild spring in southern **Ontario**, nest-building began around 1 March, and possibly from a renest, nestlings fledged as late as 5 July.



**6 months post-fledging** Tail feather #6 is the most outer with an off-center rachis (asymmetrical vanes) and #1 is a central tail feather; there are 12 tail feathers, all with rounded frayed tips that indicate a HY crow. It was a juvenile male from Chatham, **Ontario**, found dead in early December 2011. There are 10 barbs per 5 mm along the rachis





**American Crow 6 months post-fledging** Positions of 3 primary feathers on the wing are indicated by changes in shape and size. Bird found dead near Chatham, **Ontario** in early December 2011

The early breeding season of the American Crow is partly attributed to its color. A coat of black feathers is more comfortable in cooler



Ripening fruit (acorn) of Bur Oak

temperatures. If the **Guelph** nesting season was delayed a month or more, adult crows would be making 50 or more feeding trips a day to the nest in July, the hottest month in the year. As it now exists, gathering food in the open in May and June to feed the young is a more pleasant task. In these two months, insects are hatching, and large earthworms became available in March.

The nestlings are about to leave their nest. For at least the last week prior to fledging, they have been flapping their wings. Their balance and coordination improve from hopping and flying back and forth from nest to branch to nest.

Finally, in the latter part of May, with the corn ankle high, a young crow in Guelph left its nest-tree. It flew to a nearby tree. From there it traveled where instinct, ability and luck dictated.

### Fledging dates

**Cape Cod MA** 26 May–26 July c56

**Manitoba** latest dates 6 July in south, and 23 July at Churchill t18

**Winnipeg MB** 29 May–19 July r28

**Illinois** 5 May, the majority in May g55

**Arizona** 23 May 20c

**Kentucky** 10 May young left a nest 16m

Crows from two nests fledged after 37 and 41



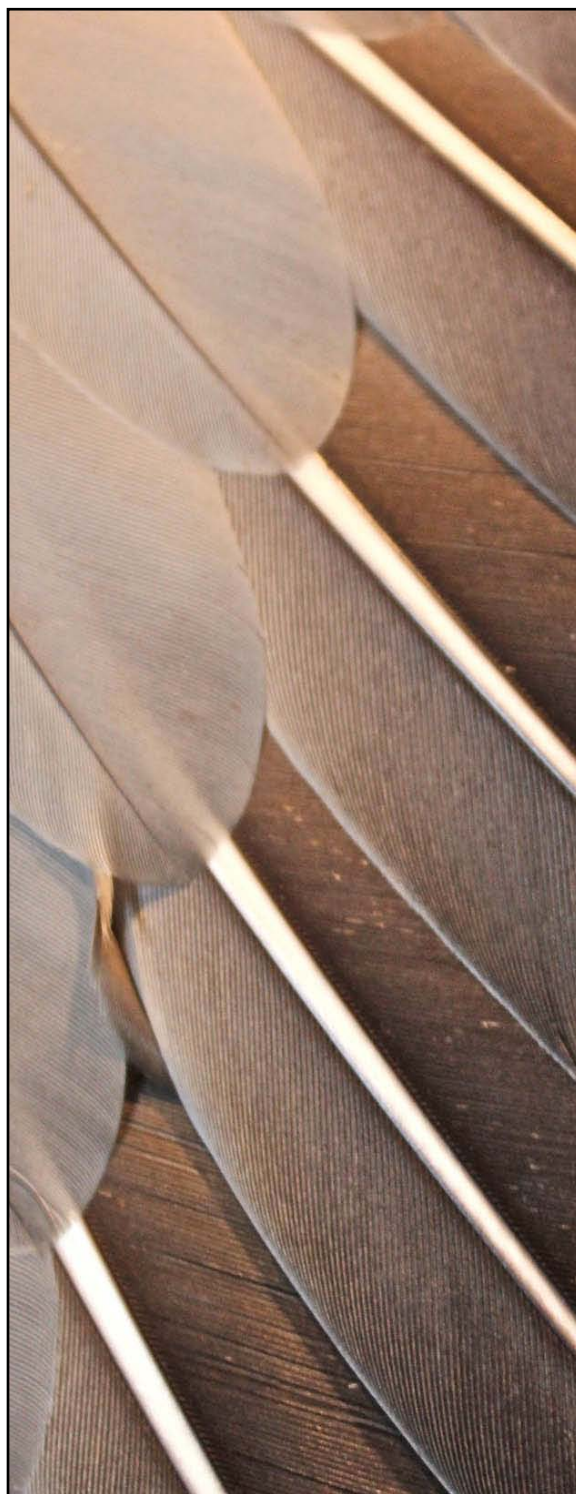


days, the longest period recorded and published k63. In **California**, the mean nestling period was 41 days. New fledglings perched in trees near the nest-tree for about 10 days before they attempted to land on the ground c09, c11. At Cape Cod **Massachusetts**, for 15 nests the mean number of days until a young fledged was 30 (16–36) within the period 26 May 1985 – 26 July 1983 c56. Nestlings in southern **Saskatchewan** fledged at an average of 31 (30–34) days of age. At this time the average weight of a 30-day-old nestlings was 380 g for 11 birds i04. Anyone who has watched newly minted juvenile crows in June and July know they appear skinny compared to their parents. Over the summer they continue to increase in weight and size. RG Clark (unpublished data) collected juvenile crows from July to September and their average weight was 422 grams.

The nestling period is quite variable. The shortest time is probably accelerated when researchers climb to a nest to band the young at 28–30 days of age. The young might bail from the nest onto branches beyond the reach of the researchers. Whether or not they return to the nest after bailing is never mentioned in the journals. In Stillwater **Oklahoma** fledging occurred 36 (33–43) days for 18 young in 8 nests v18.



American Elm



Snow Goose

Prior to fledging the young crows move up and down through the branches. Caffrey noticed parents leaving food on a nearby branch and call-

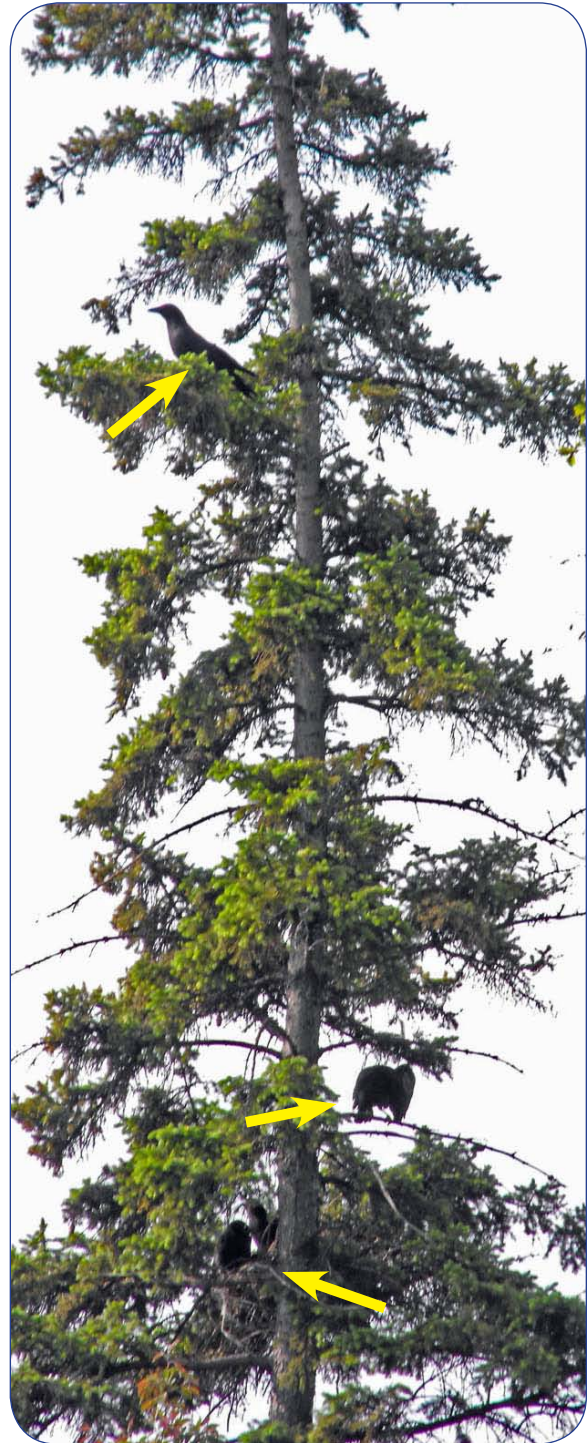




Fledgling, a week after leaving the nest, suns itself and reveals its pink mouth

ing to entice their young to abandon the nest for good v18.

**N**estlings do not all fledge at once. Their growth over the past month has been uneven. Some hatched a day or two ahead of their nest mates. The largest (most developed) and perhaps the most aggressive may initiate the process. Parmalee noted the heaviest nestling was the first to fledge in two nests, but this was not a hard rule p10. It would be interesting to know if females are generally the first to fledge. An hour before sunset I sat below one of the first nests I had located in a deciduous tree. One young crow was two meters above the nest. A lone parent quietly watched from a distance as a moderate wind brushed its feathers. Thirty minutes passed. Then this fledgling took flight and sailed through two adjacent trees and landed in another tree 30 m away. With much wing flapping it gained a toehold and maintained its balance. It did not call. Its three nest mates were restless, alternately performing spells of wing flap-



Nest, nestlings and a parent (top) occupy a solitary spruce tree in **Winnipeg**. This nest was built just above the middle, and by the winter the nest had fallen from the tree



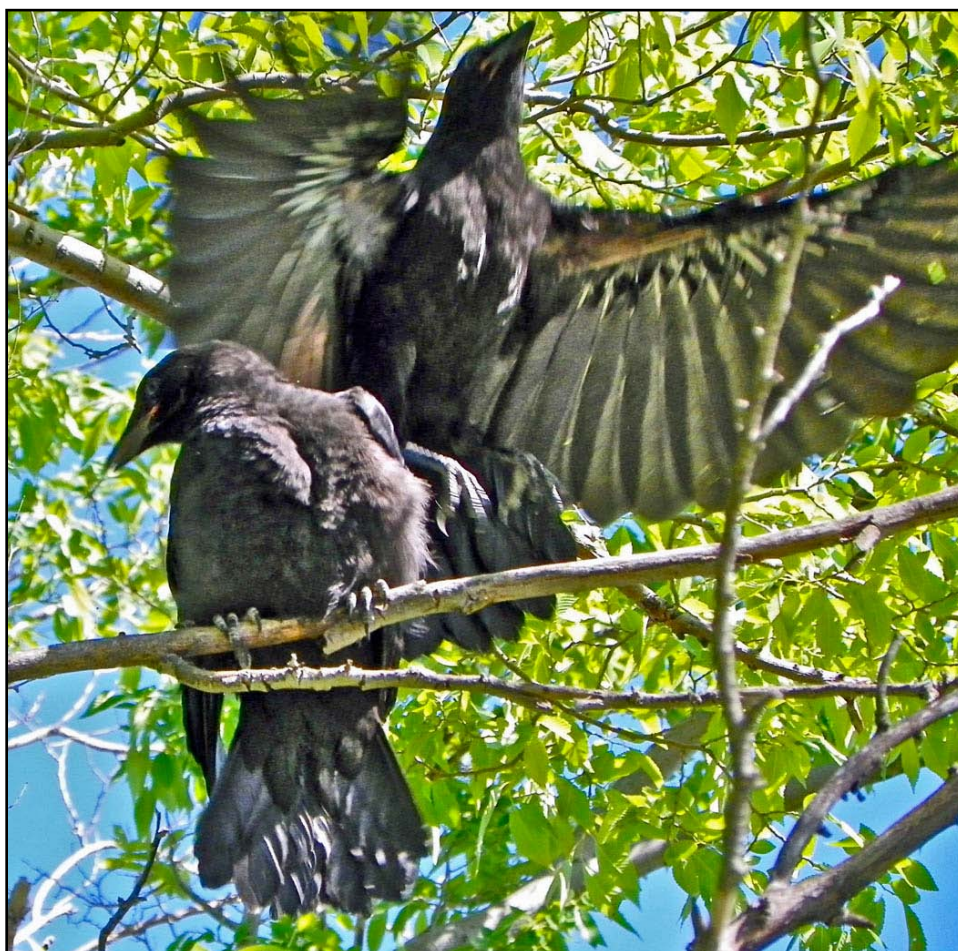


ping and preening. By 09:00 the next morning, the nest was empty. Three fledglings perched midway in two deciduous trees and the fourth was on the ground. I returned it to a low branch. They did not return to their nest again. A month later six crows flew in the area. Another successful nesting season was behind the parents. At other nests, it may take 2 days for all the young to leave. At 17 nests, 88% of all nestlings left their nest in one day <sup>c11</sup>. Three groups of juveniles did not leave their natal woodlots until after their first 6 weeks of freedom <sup>20b</sup>.

Nest-trees usually have other trees nearby to facilitate the first flight of fledglings from their nest-tree. When the nest-tree was an isolated one, the fledglings left the nest at day 35 and did not fly to a distant tree until almost two weeks later <sup>g34</sup>. When a Northwestern Crow nest was built on the ground, the flightless fledglings had

to walk 30 m through tall weeds to a nearby tree <sup>4b0</sup>.

The first nest I located in **Guelph** was in late March, one block from where I lived. It was a success, for the crows and myself – a great way to begin my crow watching for this ebook. The last nest I had under observation that year ended in an unusual way. It was late June, and I was anxious to add the nest in a spruce tree to my success column. Every second day I arrived to watch as the parents made a few feeding visits to one large nestling. Early one morning the nest appeared empty. For five minutes I held the binoculars on it looking for a slight movement of black signifying all was well. It never came. Eventually an adult flew in and landed near the nest. Another five minutes passed, but the parent did not leave. A bit long for a nest-visit it seemed, so I drove to within 40 m of the nest and again peered through



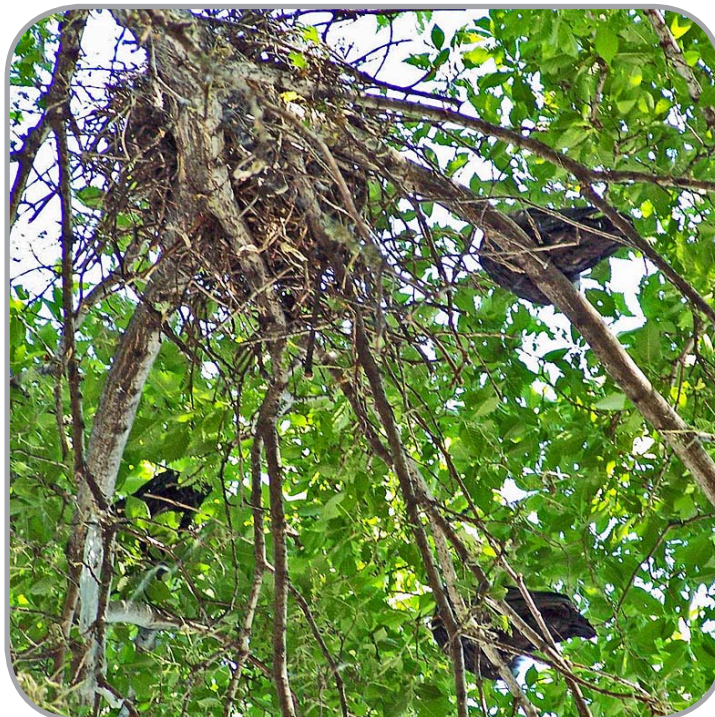
Two juveniles





my binoculars. After a few seconds the abstract form of death appeared. The fledgling was hanging by the tip of its right wing. Somehow, perhaps during a bout of wing flapping, the wing pierced the point of a broken branch above the nest. The nestling must have struggled until dead. Flies were buzzing around the body. For 20 minutes the parent perched almost touching the lifeless feathers, snapping flies out of the air or when they landed on the body. I wondered if this was simply another meal of insects, or was the parent, in the only way possible, trying to maintain the integrity of its young? I believe the latter.

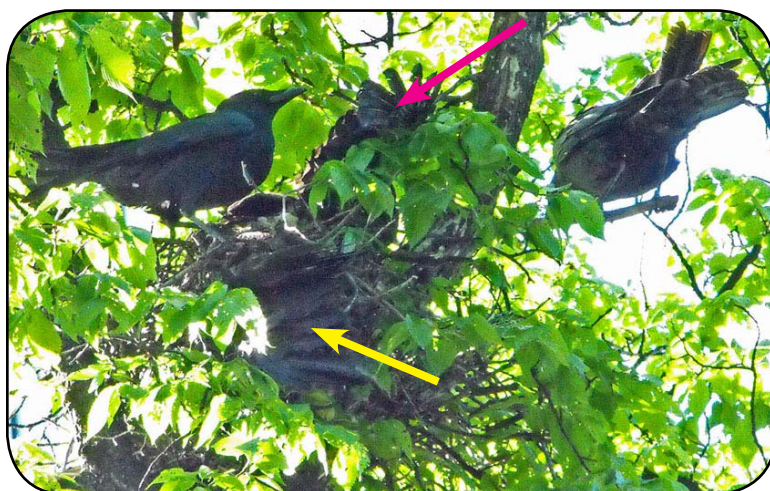
At a nest in an American Elm in **Winnipeg**, three large, well-feathered nestlings began to slowly die over a period of several days. The first fell over the nest's rim and was held in a horizontal position near the base of the nest by a cluster of small twigs. The next young eventually fell from the nest to the pavement, as related by a woman who also noticed the plight of the crows. The third bird lay in the nest, the tips of its primaries and tail feathers badly damaged as the bird flapped and tried to regain its balance. The parents often perched on the nest's rim and watched their dying nestlings, or gently lifted the wing feathers (even of the dead bird) to no avail. The large nestlings may have been fed poisonous food by their par-



**American Crow** Three nestlings on branches near their nest in an American Elm in **Winnipeg**. Once they leave their nest-tree they have fledged and once on the ground I refer to them as juveniles

ents, or possibly succumbed to West Nile fever. The next year, probably the same pair of crows had a successful nest in another American Elm tree 60 m from the old nest site and on the same side of the street.

It is generally the habit of fledgling crows in **Guelph** and **Winnipeg** to take up residency in



Young crows about to fledge in an American Elm died over several days, possibly from West Nile fever. One nestling is dead (yellow arrow) and one is dying in its nest as parents on both sides watch. This unmarked pair, without helpers, successfully nested in the same area before and after this difficult year in **Winnipeg**





A juvenile American Crow in **Winnipeg** on 29 July 2011 exhibits long skinny legs and an overall gray look. A Mallard is swimming

deciduous trees as they fledged from a deciduous or coniferous nest-tree. Generally they were quiet, but to signify their hunger, high-pitched, single-note begging caws were combined into long bouts filtered through green. As a parent approached with food, the begging intensified. Wing flapping was added as a further visual feedback that helped a parent locate the hungriest offspring among the branches. Ten juvenile Northwestern Crows began feeding on their own about 28 days after fledging 4b0. My young captive crows at 4 to 5 weeks of age were pecking at food on the bottom of their cage. Walking around outside the cage, they found the movements of small insects very attractive. By late summer juveniles were independent enough to gather most of their own food. However, a juvenile Northwestern Crow was fed by a parent 77 days after leaving its nest 4b0. [This may not have been a hunger issue, but one of social acceptance.]

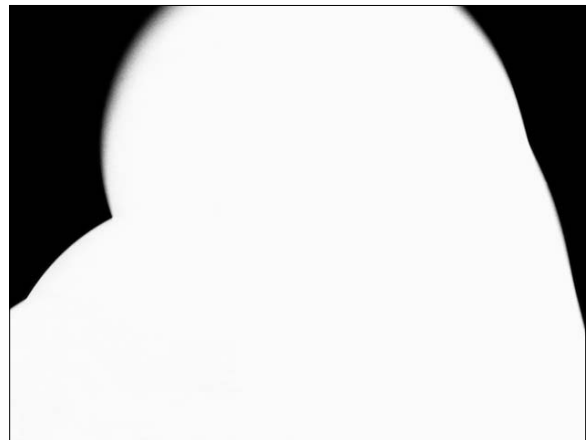
## Dispersal

The dispersal behavior for the American Crow is difficult to describe. Crows are quite plastic in their timing of when to leave their natal territory, how far to go, when to first nest, and if or when to return to their parents' territory.

In a long-term study of marked crows in and around Ithaca **New York**, the survival of juvenile crows in their first summer (HY) after leaving their nest was higher in the burbs than for rural families. However, after their second year the annual

survival was more than 70% in both areas. Dividing the crow's life into 3 age classes to fit the data did not change much compared to using only two age classes, ie. juveniles and older birds m85.

Fifty-seven (57) crows marked as nestlings settled in or near their natal areas when old enough to begin breeding. One male and one female crow, from a group of 49 crows raised in the burbs, resettled and nested in the country. None of the 8 country bred crows opted for a hectic, garbage-filled, noisy urban life. Dispersal to their first nesting site ranged from 0–60 km for all crows. Crows raised in the city dispersed 3.2 km



A cloud in the morning





for their first nesting experience, while rural crows managed to move a similar 3.3 km. In particular, 3 city crows flew to a nearby city to nest and one country crow first bred on the other side of Ithaca from where it was raised m85.

In Encino **California**, six of 43 (14%) marked juvenile birds left their natal core and joined a nearby flock of nonbreeding crows with birds from 4 months to 7 years old (the latter a male that lost its mate). Eventually, three of these 6 (50%) returned the following year (as yearlings) to their natal territory. Ten (23%) of the 43 disappeared from her study area. By 27 January, (63%) of the 43 remained on their natal area with their parents. Other young crows had left or were not seen again (21% of the original 43 crows). By the next breeding season, 21 (49%) of the 43 were with their parents c09. In Stillwater **Oklahoma**, one crow, the earliest to depart at 9 months, moved in with another family v18. ■

Petals fly from the peach trees  
Along the river. Willow catkins  
Fill the air with floss. And then—  
In the orange twilight—fall  
Widely spaced drops of rain.

— Li Ch'ing-chao r47

